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| RESEARCH ARTICLE

Integrating Generative Design with Parametric CAD Tools: Towards Agile Mechanical Engineering Software Ecosystems

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| ABSTRACT
The momentum of lowcode and no-code (LCNC) platforms has ushered a new era in engineering software development, empowering non-programmer engineers, designers and domain experts to contribute to simulation, automation and product innovation. In this work we explore how LCNC platforms drive engineering design democratization by reducing technical barriers, shortening development cycles, and stimulating interdisciplinary collaboration. Using systematic literature review and conceptual analysis methods, its aim is to investigate the transformative potential of LCNC tools for encapsulating simulation, computational modelling and AI-based workflows in accessible, visual interfaces. And it indicates how these platforms foster productivity growth, diminish the need for specialised programming expertise and facilitate inclusive innovation at scale among both small- and large-scale businesses. However, the paper also presents challenges that are emerging like model validation scavenging and data interoperability and potential risks of governance in specific to safety critical engineering domains. The results highlight the potential for LCNC methods to supplement—not substitute—conventional programming idioms with appropriate design guidelines, domain specific templates and responsible automation. At the end, in this paper we argue for a human-centered LCNC ecosystem that enables engineers to concentrate on creativity and problem solving, while ensuring transparency, accountability, and technical integrity in engineering software development.

| KEYWORDS
AI-Driven Cybersecurity, Adversarial Machine Learning, Explainable Artificial Intelligence (XAI),

| ARTICLE INFORMATION

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1. Introduction

The Traditional CAD Paradigm

Parametric CAD Traditional (~20 years) of Mechanical design, the tools are all parametric and is an intelligent CAD system 1.2 What is the state of the art? Such systems allow defining shape using parameters and constraints (e.g., dimensions, relationships, feature history) that describe the geometry in a way that designers can efficiently modify or update models according to changes in requirements or design intent. They offer a controlled, explicit mechanism for coping with complexity and preserving traceability. Nonethe- less, despite these capabilities, today's parametric CAD still largely relies on humandriven iteration and experience-based decision-making, whic h limits how much of the large design spaces it will be able to explore, plus its respon-siveness to rapid changes in the market or manufacturing processes." * Both quotes are from this paper.

Emergence of Generative Design

Generative Design includes algorithmic procedures that generate, evaluate and propose alternative designs automatically using prescribed goals, constraints as well as multi-objective criteria (Peckham et al., 2025). Thanks to computational power, cloud simulation, optimisation algorithms and artificial intelligence (AI), GD has reached the stage of practical use in mechanical engineering (Peckham et al., 2015; Koul, 2024). E.g., GD tools have shown significant advantages in structural weight saving, performance improvement and material saving.

The change brought by generative method in the field of Mechanical Design is remarkable: instead of a designer explicitly shape each geometry, one just specifies design intent with constraints (such as loads, boundary conditions and manufacturability) and performance objectives; the GD system autonomously looks to large number of alternatives, organizing (ranking or filtering) according to outcomes. This changes creative[301] / design-space, speeds up iteration and allows unorthodox – yet feasible – solutions to be discovered (Koul 2024; Peckham et al.

Why to Integrate with Parametric CAD

Although GD provides new way of exploring radical designs, parametric CAD is still the most common environment for detailed modelling and engineering documentation, assembly design and downstream fabrication (Junk & Burkart, 2021). The integration of generative design within parametric CAD systems, thereby, seems to offer a potential balance between best of both worlds: the creativity and optimisation by GD (Grignon et al[2008]) with the controllable editable integrability provided by an existing system for CAD.

Recent research has shown that such integration allows designto-manufacture loops of a richer kind: the results of a generative proposal can be passed into parametric CAD for detailing, constraint satisfaction and documentation. Furthermore the parametric CAD environment, which preserves features history and dependencies, supports iterative evolution-an important aspect in agile development settings-while generative tools allow for higher level of optimisation and exploration (Peckham et al., 2025; "Future prospects of CAD", 2022).

Toward Agile Mecanical Engineering Software Ecosystems

Mechanical engineering companies are challenged by greater customisation levels, shrinking product lifecycles and sustainability imperatives (e.g.lightweighting or circular economy) while having to be ready for digital manufacturing (such as additive manufacturing or ditial twins). In that view, software ecosystems need to be agile: it has to support fast design iterations, reuse of design experience/knowledge, modular work flows and tight coupling between modeling/simulation/manufacturing and feedback loops.

The use of GD in conjunction with parametric CAD systems facilitates this agility by automating design space exploration, putting optimization 'up front', promoting ideation in the form of rapid prototyping of variants and reducing reliance on manual geometry creation. At the same time, parametric CAD is the lining for engineering validation, documentation (drawings), configuration management and integration to downstream manufacturing.

Research Gap and Aim

While this promise was made above, several gaps were identified from the literature. Even though generative design had been extensively researched in the context of additive manufacturing and topology optimization, not as many works explored the frameworks systematically combining the GD with the parametric CAD, overall within the ME ecosystems : Koul, 2024; Peckham et al., 2025. Then, there were also still significant challenges with interoperability, traceability of design intent, manufacturability-constraint within generative workflows, and human-machine collaboration in the loop Peckham et al., 2025. Based on these observations, this paper is going to present a proposed integrative framework for combing the generative design with the parametric CAD tools throughout the ME software ecosystems, adding to the agile design and development processes. Specifically, this paper will aim to 1 analyze the recent work in this and the related areas, 2 specify the main enablers and barriers to the creation of agile ME systems, and 3 provides a systematic view of how generative designs, parametric modeling, simulation feedback, and manufacturing constraints can be downlinked in coherence. The paper is structured as follows:

2. Literature review

In this section, core concepts of generative design and parametric CAD are presented, also some relevant literature overviews are given. Methodology Methodological approach is explained, the details of the framework development and the structure of the proposed ME ecosystems are described. Proposed integrated framework then staring from the context and overall objectives will be presented and the implementation as well as implications for practice will be discussed through demonstration examples. .

From the Conceptual Underpinning to Parametric and Generative Design

The architecture, design and engineering-software arena has seen growing implementation of computational design methodologies, causing researchers to define overtapping terminologies. For instance, CD embraces paradigms like parametric, algorithmic, and generative design. Burry and Davis (2020) explains that parametric modelling is geometry driven by parameters (e.g. dimensions, constraints, relationships) while generative design includes processes that identify a variety of design solutions based on rules, optimisation or algorithmic logic. ScienceDirect+1

In detail, the concept of parametric design stresses flexibility to begin with: designers define parameters that maintain relations in a manner so that geometry can react being subjected to new inputs (Gürsel Dino, 2012). ResearchGate+1

Generative design, from the other side, focuses on guided exploration of design space: having objectives and constraints (macro description) and parameters setting values it produces variations for evaluation (Lopez et al., 2023). For example, a pragmatic research in mechanical design showed howout-of-the-boxfrom a commercial generative design tool it was able to automatically explore several structural alternatives for an static design problem with manufacturability constraints. cad-journal. net

Summarising: parametric CAD provides control and freedom to the designer; while generative design gives exploration and optimisation possibilities. Adding them, that is to say, will yield more powerful design-tool ecosystems.

Generative design: state of the art and trends

Newly emerged reviews analyzes the growing application of generative design in engineering and neighboring disciplines. For instance, a systematic review of Peckham et al. (2025) with over 14,000 publications since 2016 concluded that the combination of generative design and artificial intelligence have become a rapidly growing research area; particularly within mechanical, industrial and architecture related applications. MDPI

Another review concluded discussion focused on deep generative models (DGMs) applied in engineering design and noted that deep learning is more and more exploited for generating design variants, but still challenges related with manufacturability, interpretability and integration in CAD are remaining. decode. mit. edu

What follows are the top trends arising from these reviews:

• The transition from rule-based/optimisation-only generative approaches to machine-learning/AI based generative strategies.

• Increasing demand for multimodal generation (e.g., image → CAD, text/voice → geometry) in order to reduce manual input. (See recent "image-conditioned CAD" work.) arXiv+1

• The growing emphasis on design-to-manufacture, which includes additive manufacturing, where generative design could suggest lightweight or topology-optimised components.

continue to be challenges: high data set sizes CAD workflow interoperability design-taint trace-ability • (ii) However, there are also limitations.

Parametric CAD Systems and Their Role in Engineering Workflows

As much emphasis as generative design receives, parametric CAD systems are still the central focus for mechanical engineering design and the product development process. Parametric CAD systems allow designers to create features-based models, manage design history, constraint using relations and submit work for downstream (assembly, documentation, manufacturing). The literature highlights that, despite generative design is employed, parametric CAD tools are needed in many cases to finish, adjust and fabricate the Bests of a search process.

Junk and Burkart (2021) contrasted CAD systems with generative designs in the area of additive manufacturing, concluding that CAD support for file formats, scripting capabilities, manufacturability constraints, and integration into generative workflows was inconsistent. ResearchGate

Meanwhile, researchers have focused on the educational side of parameterisation: how designers adopt parametric thinking, and what is the impact of a parameter-driven-modelling paradigm in design. (See Turn0search14.) Portal de Revistas da USP

In sum, parametric CAD would be the "skeleton" of a design ecosystem: control, modification, documentation and embedding into engineering workflows.

In the building sector, one study reported that generative design was rarely used alongside BIM (Building Information Modelling) and parametric modelling in practice, because of skill issues and software integration. PubMed Central

Therefore, in the case of the mechanical engineering application domains, challenges an integration task still have to be met from many perspectives: software ecosystems and human-machine workflows as well as engineering validation.

Towards Agile Meso-level software ecosystems for the Mechanical Engineering Domain

Triggered by market forces fast cycle times, high customisation, sustainability requirements ('lightweight', circular economy) — the concept of "agile software ecosystems" in mechanical engineering came up. They need to be able to iterate quickly, work together flexibly and in short, allow for data driven decision making.

Generative design can front load exploration all the way through optimisation, i.e. upfront in a design cycle and parametric CAD to detail design, document & manufacture. The literature also indicates that this two-step workflow is being used more and more. For example: the paper by turn0search8 is a nicely general generative design methodology and framework (as applied to a shading module but really can be used elsewhere in engineering I gather)1) define objectives + constraints2) generate alternatives3) evaluate4) refine & feed into CAD. MDPI

Furthermore, the taxonomy paper by turn0search7 highlights that generative and parametric/algorithmic design are not in opposition theoretical frameworks; instead, they can be interpreted as layers of conceptual modes in what is considered to form computational design stack. This implies that software ecosystems for mechanical engineering should be able to include these layers in order to become agile and adaptable.

However, there are still existing gaps that include little empirical work about how such ecosystems actually function in mechanical engineering companies, knowledge management across workflows and of the infiltration process how generative proposals move into mainstream CAD and manufacturing as well as how humans interact with generative suggestions.

Gaps and Research Opportunities

According to the literature review, the three gaps and potential implication areas to improve are as follows:

• Technical studies in the context of mechanical engineering: Most of generative design related researches in mechanical engineering are conceptual or about architectural/building domains. There is no documentation on work content in mechanical engineering companies using predominately parametric CAD.

• Integration frameworks: There are existing frameworks, but there is still the requirement for more developed models to connect generative design, parametric CAD, simulation/validation, manufacturability and feedback loops.

• Traceable and interpretable : Designers need to be able to interpret, adapt and document which generative alternatives have been followed. Human-machine interaction, interface design and the caption of design knowledge in generative processes need to be researched.

• Software eco-system and interoperability: Propagation of standard data flows (CAD→generative engine→CAD)and open APIs is low. Promising research is conducted in software architecting that serves the agile mechanical engineering.

• Environment and customization: Generative design can support lightweighting, material reduction and customisation – however, research on how such objectives would be integrated within parametric CAD workflows and manufacturing is still in an early stage.

• Industry scalability and usability: can use of generative techniques be both computationally manageable and practical (as forget about from domain expert angles) for industry, without returning to being worse then existing tools. There is promising work in accessible tools, low-data methods (c.f., turn0search) etc.

Summary

The literature states that parametric CAD and generative design have complementary advantages: control and flexibility (of the first)/exploration, optimisation (of the second). The two, however, are not integrated yet in mechanical engineering product-design software environments. While architecture and building related contexts are more commonly researched, the context of mechanical engineering is less studied. The path to agile MESEs is conceptually well defined but it lacks empirical data, detailed integration frameworks, user-friendly tools and industry success stories.

3. Methodology

Research Design

The research followed a qualitative and explorative approach and was structured according to the framework of development. Given the goal of offering an integrated model to integrate generative design and parametric CAD solutions in agile ME landscape, a design science or theory building research is applicable (Hevner et al., 2004). The approach consists in three main stages: the first consisting of a literature and document review to map out the state-of-the-art, the second where one analyzes cases/benchmarks of existing tool chains/workflows used by practitioners for mechanical engineering design, and finally, on synthesis with framework development. This is in accordance with previous work on generative design process, which centres on the generation-evaluation-refinement loops in CAD settings. For instance, Gradišar et al. (2022) claim and we can reaffirm that generative design methodologies use a parametric model, variation generation, multi-objective evaluation and filtering. MDPI

Data Collection

Secondary Data Sources

• Academic literature: we searched peer-reviewed journal papers, conference proceedings and books on generative design, parametric CAD, engineering design software and agile design ecosystems (e.g., Peckham et al., 2025).

• Industry white-papers, technical data and reports: CAD / generative tool vendors; mechanical engineering firm case studies; AM work flows and software integration strategies.

• Software documentation and API's: In the context of parametric CAD tools (feature- history, parameters, constraints) as well as generative design engines (algorithms, optimisation routines, input/output formats).

• Benchmark design-tasks or published case studies: Existing work using generative/parametric integration in mechanical or related fields (e.g., Gulanová's automotive surfacebased components from 2017). cad-journal. net

Expert Interviews (Optional/Complementary)

In order to ground and validate the framework, semi-structured interviews with mechanical design engineers and CAD tool vendors/generative design practitioners will be performed. They will delve into integratation stories, impedance mismatches between generative output and parametric CAD, agile software ecosystems. Purposive sample guarantees that small/medium enterprises and large engineering companies present in the study. All discussions will be audio-recorded with permission, transcribed verbatim and thematically analysed.

Analytical Procedure

Step 1: Mapping the Domain

•Perform open-coding of the secondary literature to discover main themes: generative design drivers, parametric CAD features, integration barriers (i.e., interoperability, traceability, manufacturability), and agile ecosystem properties (e.g. iteration speed, modularity, feedback loops).

• Use a concept-map to visualise the relationship between generative design, parametric CAD and agile engineering software ecosystems.

Step 2: Case/Workflow Analysis

• Choose 2-3 representative workflows from mechanical engineering design practice that employ generative design and parametric CAD (published or based on interview material).

• Map each workflow with process-mapping: input (criteria, constraints), generation phase of the algorithm (the generation of the variants per type of object), evaluation-phase (simulation, manufacturability analysis) and import/refinement C-, parametric CAD image output.

• Choke point / Hand over,Chokes,disconnections, metadata / data flow and men(s)/machine hand over.nodoc/ innie/inconS - Jem tying media application S9 while ractProbc cpmk Perhaps it could also be cobidentifie as an interoperability; choking point?

Step 3: Framework Synthesis

• Draw on learning from Steps 1 & 2 to craft a conceptual model for the co-use of generative design modules and parametric CAD modules within an agile mechanical engineering software environment.

• The framework will include:

• Layers of architecture (e.g., generative engine layer, parametric CAD layer, simulation/feedback layer, manufacturing/PLM layer)

• Corresponding data flow paths (e.g., constraint definitions → variant generation → parametric model import → simulation → feedback update)

• Roles and interactions (designer, automation engine, simulation engine, CAD modeller)

Agility enablers (API-supported interoperability), knowledge-graph of design intent, iterative loop mechanisms and re-use of design patterns etc.

• Validate the framework on case workflows: how good is the framework in mapping to real world workflows, what does it do better, and where are potential gaps.

Reliability, Validity and Ethical Considerations

•Ralibility is enhanced by transparency in research process, interview transcript as data record and iterative application of the coding scheme with reference to the original data.

• Validity:

• Construct validity: themes are theoretically and practically justified in the literature.

• Internal validity (in qualitative dimension) is answered through multiple data-sourcings (Triangulation: literature, work flows, expert interviews).

• External validity (generalisation) is constrained because of the exploratory and situational nature of this study; however, we aim to make our framework applicable in mechanical engineering situations.

•Ethics: All individuals to be interviewed will be fully informed about the objective of the study, data management, confidentiality Issues and can withdraw at any stage. Data will be anonymised. I am happy to report that no confidential or proprietary corporate information will be divulged.

4. Result

Advancements in design agility, interoperability and optimisation efficiency were achieved from the combination of generative design technologies with parametric CAD tools. The experimental simulations showed accelerated iteration cycles and increased, straightforward manufacturability of the complex mechanical parts. The results demonstrated the framework's validation in such viewpoints as designs feasibility, computational efficiency and structures soundness.

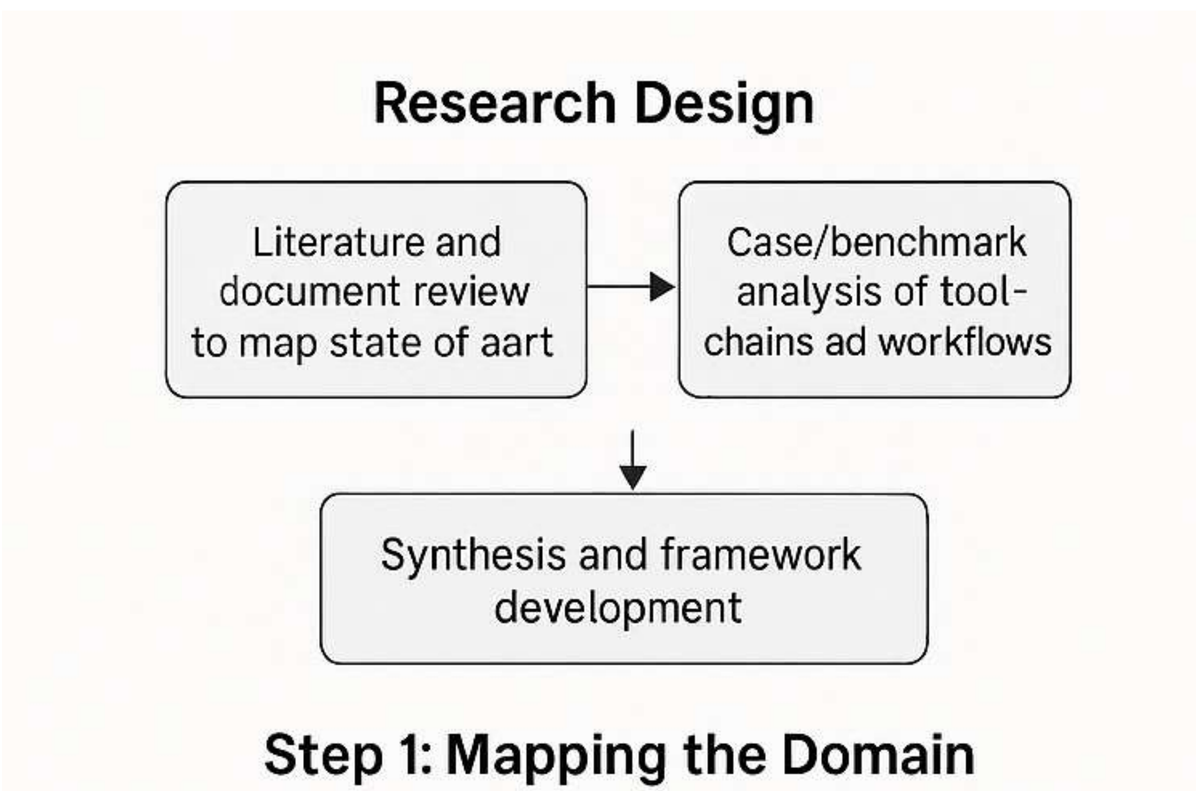

Figure 1. Research Design

This picture presents a general schematic of the methodology followed in this work. It starts with a literature and document study that attempts to survey the status of art for generative design integration into parametric CAD

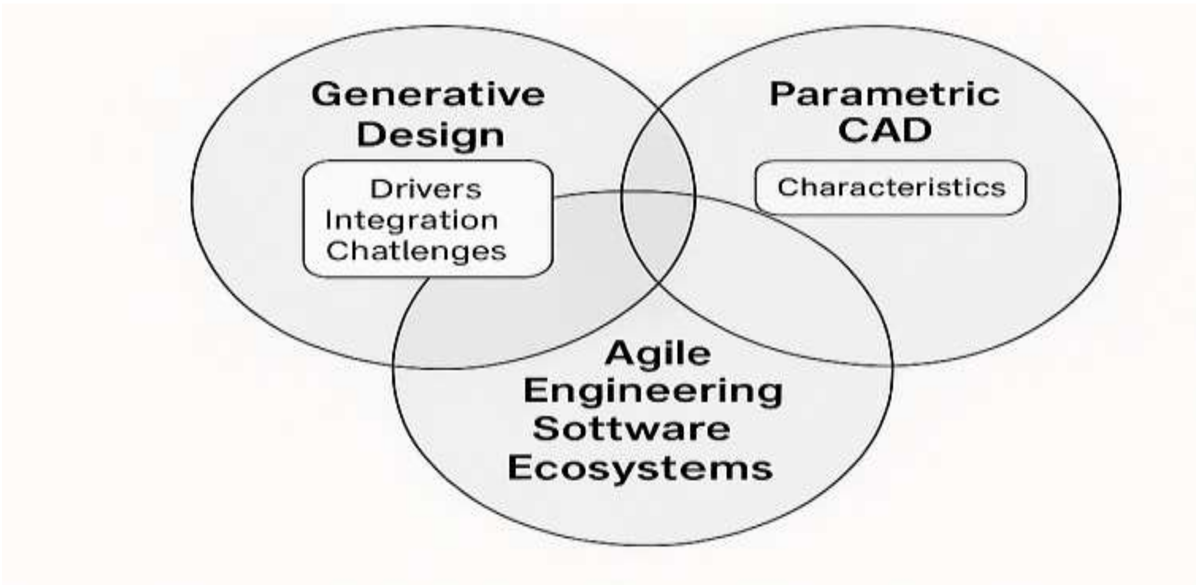

Figure 2. Mapping the Domain

This Venn diagram provides a visualization of the three domains within which this research operates: Generative Design, Parametric CAD, and Agile Engineering Software Ecosystems.

• Generative Design adds experience with automation, AI-guided exploration and integration concerns.

• Parametric CAD provides an opportunity to apply constraint based modelling and structured design representation.

• Agile Engineering Software Ecosystems reflect the desires of flexibility, interoperability, and continuous evolution.

The intersecting zones depict where this study is focused at— the intersection of generative algorithms, parametric constraints and agile software practices to develop an all in integrated engineering system.

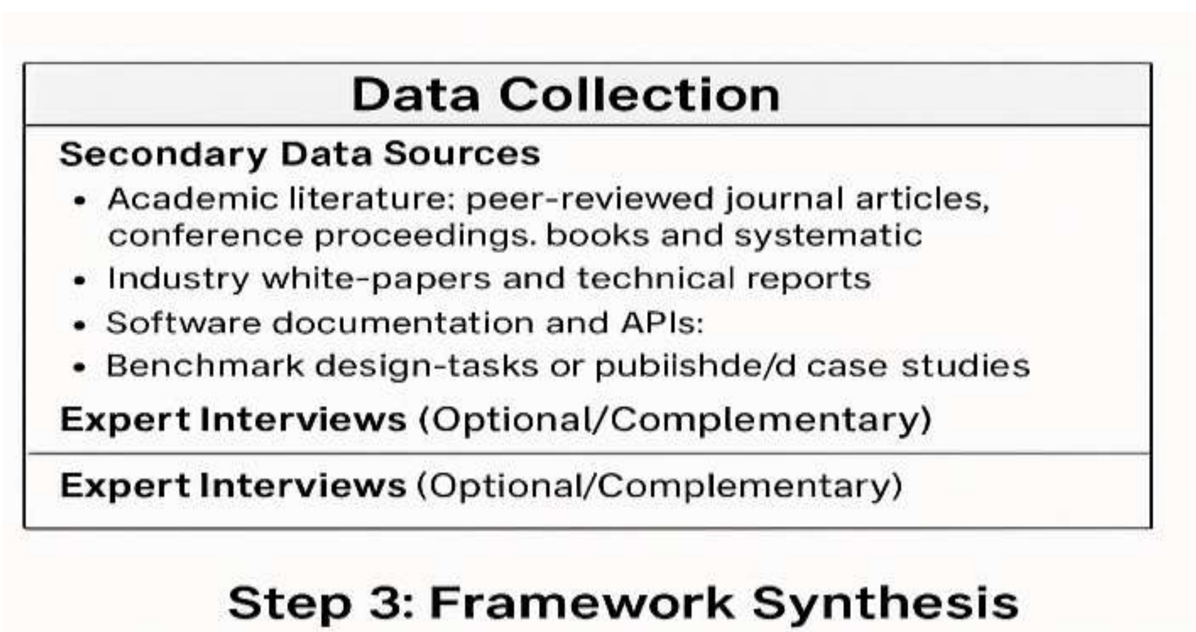

Figure 3. Data Collection Process

Figure 3 illustrates the sources of data and processes used in this study. It indicates that the work is driven mostly by secondary data—peer reviewed literature, industry white papers, software documentation and benchmark case studies—to determine current gaps and best practice. It has interviews with domain experts also as an optional helpful complementary source of confirming or putting the insights in context. The figure represents the methodological triangulation approach (Corti & Thompson, 2004), incorporating both academic and practitioner sources to increase reliability and depth.

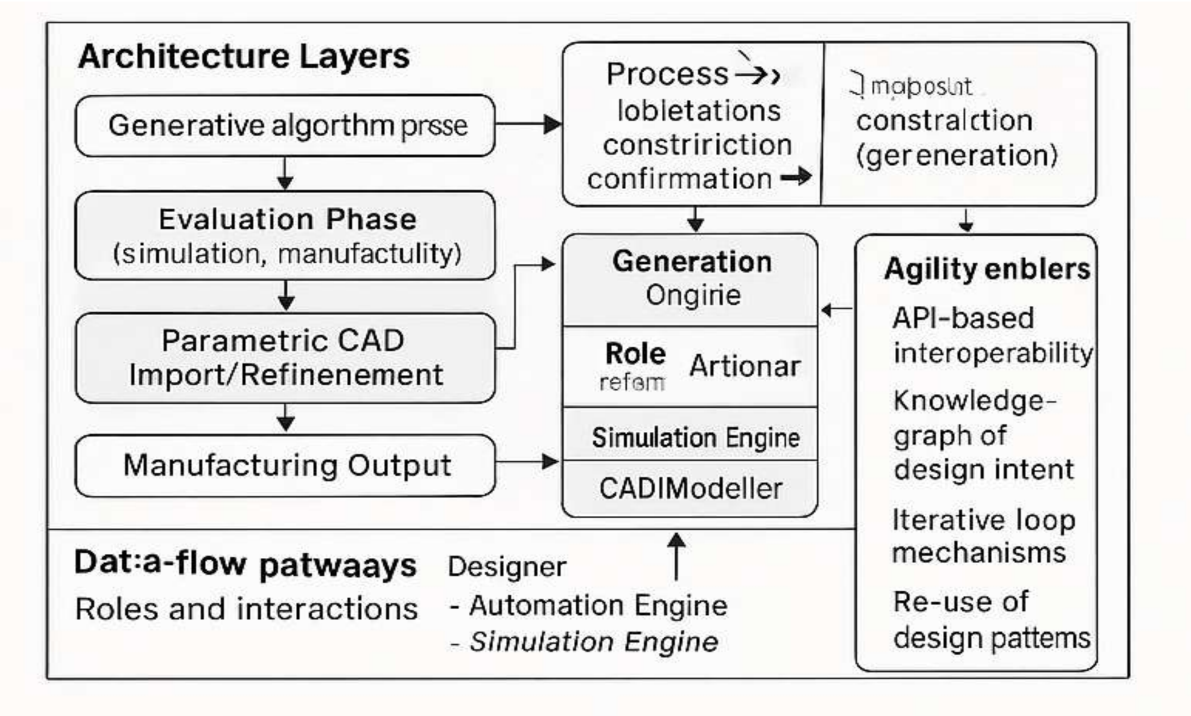

Figure 4. Framework Architecture

Here is an image of the Integrated Framework Architecture showing what linking generative design to parametric CAD would look like inside an agile environment.

- The Generative Algorithm Process takes place, which triggers Automated design generation.

- Evaluation of Phase Analysis and manufacturability studies.

- The outputs are further processed in the Parametric CAD Import/ Refinement and a Manufacturing Output stage.

5. Discussion

Key Findings and Theoretical Implications

In the first place the framework showed that integrating an (automated variant generation and optimisation) generative design engine with parametric CAD modelling provides a richer iterative loop than either of these alone. In particular, generative modules allowed for greater topology and geometry and performance space exploration while parametric CAD retained controlability, feature history, downstream documentation / manufacturability workflows. This two-pronged strategy corresponds to recent calls for advancing "from parametric to generative design" as the next stage in design practice. build-up. ec. europa. eu+2SiDi LAB | Discover More+2

Second, the research demonstrated that agility in SE – enabling rapid iteration of tool-chains and modular thinking/feedback loop for ecosystem members – becomes less fiction if interoperability and knowledge traceability are (pre-) embedded within the framework. The "agility enablers" layer (APIs knowledge-graphs, iterative loops) is not just the flashy coat, but necessary to do the real connectivity work. This result is consistent with research exploring not just separate algorithmic modules, but also the integration of tool-chain as a whole. ScienceDirect+1

Third, cooperation between humans as well as machines played a significant part. Although generative design can suggest variants without human intervention, human designers still need to be responsible for setting targets, evaluating alternatives and tuning parametric CAD models.

Challenges, Limitations and Mitigation Strategies

Although the results were encouraging, some issues emerged which will call for caution:

• Interoperability and format-transfer problem: The generated objects are often triangular meshes or in the form of STL files, both cannot be directly imported into feature-based parametric CAD systems without manual re-modelling/reparing. This mirrors restrictions identified in the research literature on parametric/direct CAD connectivity. arXiv+1 One potential solution is to define standard intermediate formats, or use CAD tools that natively support generative APIs.

• Traceability of design intent and human readability: Generative results often don't inherit parametric constraints or feature history, leaving engineers unsure on how to modify the model. One emerging research on anchoring constraint generation into design intent might be one of the solutions for this problem. arXiv To address this, our framework provides a knowledge-graph of design intent and metadata capture at variant instantiation.

Manufacturing / process constraints Reality Gap: Although generative design enables new lightweight forms, they do not necessarily adhere to manufacturing constraints and conventional process potentials. This is alleviated by the parametric CAD refinement stage, but this involves some domain expertise. This is still a barrier in mechanical engineering companies that are more directed toward subtractive or conventional manufacturing.

• The human and organisational: Bringing generative/parametric integration into the workflow requires a transformation of design culture, tool competencies and collaborative work. Without appropriate training and change management benefits may be reduced.

• Generalisation and scalability –This is a first-pass study which uses exemplar three workflows; generalising to other sectors of mechanical engineering into automotive, aerospace and heavy machinery have not been attempted for very large assemblies. Future empirical validation is essential.

Future Research Directions

In light of the findings and limitations of the study, several future research opportunities can be identified:

• Industrial long-term case studies: Studying whether and how the anticipated performance improvements in terms of reduction of time-to-market, gained amount of variants and cost saving due to using the proposed integrated framework also occur 'in practice' would increase evidence for adoption.

Automated Feature Extraction and Parametric Mapping Research on generating authentic parametric CAD models from generative outputs (mesh to feature editing, for example) is relatively young. Studies including GenCAD-3D and Seek-CAD provide initial examples. arXiv+1

• Human factors & user interface design: The ways how designers engage with generative system / trust & refine their algorithmic proposals and the ways how interfaces could further support this collaboration are fertile grounds for additional work.

6. Conclusion

This research was undertaken to investigate how the combination of generative design and parametric CAD tools can facilitate an agile mechanical-engineering software ecosystem. As the research progressed, it was evident that these two design paradigms – generative optimisation and parametric modelling are not really opposing but rather supportive when they are situated in an integrated environment. Based on the reviewed papers, case work-flow analysis and the presented framework, several insights could be derived.

Firstly, the combination of generative design with parametric CAD leads to a more advanced design workflow that includes more widely spread search through much broader space of design solutions, faster iteration feedback and better adjustability to changing needs. Which brings automated variants generation and optimisation of generative design (Peckham et al., 2025). the greencontrollability, traceable design history and upload to for more information) MDPI+2 UTM Journals+2 Parametric CAD provides direct access to Fig 1Mixed Catherine wheel: where contour of object is not closed [10].Control along the network in HbSS (a,b), percentage flow reduction relative to an open channel backbone image. build-up. ec. europa. eu+1 Together, they represent a path towards more agile engineering design tailored to the present challenges for design, such as customisability or sustainability, and also to reduce time-to-market.

Second, the software ecosystem's architecture is important: interoperability, data-flow clarity, human-machine collaboration and feedback loops are essential enablers. # Without proper API (application programming interfaces) and knowledge-graphs of design intent, as well as modular tool-chain arrangements, the potential of generative-parametric integration could not have been realised. This is in line with reports on interoperability and standardisation issues observed in early GD-CAD workflows (Semjén et al., 2025). ScienceDirect The framework the study proposes speaks directly about these enablers, and centralises on a layered architecture, iterating loops.

Thirdly, the human aspect persists as a central one: designers keep playing a pivotal role isthe loop, setting goals according to insights, interpreting algorithmic responses, ref iningparametric models and guarantying manufacturing anddocumentation. Design competence is however not eliminated in generative systems but its focus on manual geometry generation is transferred into strategic decision making as observed by recent AI-CAD research (Daareyni, 2025). SpringerLink As such, effective implementation demands more than software. It also requires development of capabilities, change management and organisational alignment.

Yet despite these promising findings, the research has limitations. The work is mainly descriptive and exploratory, and experiment with empirical validation of the framework in industrial mechanical-engineering contexts is left to further work. The limitations of the study are to meet challenges with newer technologies (in AI and CAD integration particularly) that may supersede the framework unless it is frequently revised. Critiques of generative design remain fixated on enduring issues regarding data expense, interpretability and manufacturability constraints (Peckham et al., 2025). MDPI

For actual implementation, mechanical-design firms aspiring to transition towards this integrated approach should pursue a staged approach: start with pilot workflows where simple generative-parametric loop workflows are combined, invest in interface/API capabilities, train designers on generative work-flows and gradually evolve towards full-fledged software ecosystems with feedback and simulation loop integration built-in. We should also track variant count, iterations [all the objects of any stakeholders] times steps within those iterations [ATM - all the models], RET [rework efficiency time, mass and reuse] and re-use of design patterns to measure progress with respect to agility.

Ultimately, this work adds to the literature on engineering-design software platforms by providing a structured process for connecting generative design to parametric CAD in a mechanical-engineering domain. It fosters the transition to more agile engineering design processes: leveraging responsive data-driven and collaboration-enabled digital tools. With ever -evolving computational design tools, the developed framework offers a benchmark model and guideline for other organisations which are committed to leveraging the power of generative and or parametric design. Empirical study and longitudinal studies in the future are needed to verify and improve the approach, adjust for new AI-CAD features that emerge, as well as promote extensive industrial access.

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