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EDITORIAL

Formal methods in the scope of the Software and Systems Modeling journal

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Software and Systems Modeling (SoSyM) is a journal dedicated to advancing the field of software and systems modeling by publishing high-quality research that contributes to the theory and practice of modeling in software and systems engineering, which also includes processes executed automatically or involving humans. The journal aims to bridge the gap between academia and industry by fostering discussions on modeling languages, methodologies, tools, and their applications to real-world challenges. SoSyM encourages submissions that present innovative modeling approaches, their precise semantic foundations, empirical evaluations, and applications that have tangible impacts on software and system development processes.

Given this mission, the journal welcomes research on formal methods, provided that such work is framed within the context of software and systems modeling. Formal methods, as mathematically rigorous techniques for specifying, developing, and verifying software and systems, undoubtedly have significant potential to enhance modeling practices. However, the focus of SoSyM is not formal methods in isolation but rather their role and contribution to the field of software and systems modeling.

Thus, a manuscript that centers on a formal method must explicitly articulate its relevance to software and systems modeling. This means that a submission should not merely introduce a new formalism or theoretical result; instead, it must also ground the contribution in a concrete modeling challenge or need within the software and systems modeling domain. Note that the use of the formalism for reasoning is not sufficient, per se! Authors should clearly demonstrate how their work advances the state of the art in modeling by addressing specific problems, improving existing methodologies, or enabling novel applications. Moreover, an evaluation should be provided to illustrate the impact and practical applicability of the proposed approach within the modeling domain. Such an evaluation should leverage one or more case studies that are representative of real-world challenges.

Furthermore, positioning is crucial in establishing the relevance of formal methods research to SoSyM. Manuscripts should not only compare their proposed formal techniques against existing formal approaches but, more importantly, situate their contributions within the broader landscape of software and systems modeling. This includes discussing how the proposed method relates to and extends existing modeling techniques, frameworks, and tools.

For instance, a submission might explore how a formal verification technique enhances model-based software design by detecting inconsistencies in UML state machines before implementation, thereby preventing costly errors. Another example could be the application of formal refinement techniques to ensure that high-level architectural models, e.g., defined in SysML or another ADL, correctly translate into executable system components, improving traceability and correctness in model-driven engineering workflows. Likewise, work on domain-specific modeling languages (DSMLs) could integrate formal semantics to enable a precise understanding of the meaning of a model, or even automated reasoning about system properties, such as safety, security or performance constraints, within a modeling environment. Case studies demonstrating how formal methods improve the precision and reliability of digital twin models of cyber-physical systems would illustrate their practical impact on real-world modeling challenges. These

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examples highlight how formal methods can meaningfully contribute to software and systems modeling.

However, a paper that solely introduces a new temporal logic without demonstrating or at least discussing its relevance to modeling practices would not be suitable, as it lacks a concrete connection to software and systems modeling challenges. Similarly, a study that proves theoretical properties of a formal specification language without showing how it improves a modeling methodology or tool would not meet the journal's criteria.

Another counter example is work that extends a modeling notation, e.g., by encoding numerical constraints or data properties, with the primary goal of enabling effective reasoning, without specific integration in a development setting. In these cases, while the research may really be valuable within the realm of formal methods, it does not sufficiently engage with the core mission of advancing software and systems modeling without tying the verification process to a practical software or systems modeling context, and thus, the paper would be out of scope for SoSyM.

In summary, SoSyM welcomes research on formal methods insofar as it aligns with the journal's core mission of advancing software and systems modeling. Authors submitting such manuscripts should ensure that their contributions are motivated by concrete modeling challenges, supported by rigorous evaluation, and positioned within the broader software and systems modeling research landscape. By adhering to these principles, contributions from the formal methods community can play a vital role in strengthening the field of software and systems modeling and fostering meaningful advances in both theory and practice.

We look forward to receiving high-quality submissions that apply or integrate formal methods into the rich and evolving discourse of software and systems modeling.

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