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Dear Madam, Sir,

It is a great honor for us to nominate for the FME Fellowship Award.

Prof.dr.dr.hc.ir Joost-Pieter Katoen, PDEng

Professor Katoen is a highly successful researcher in stochastic model checking and reliability engineering. Just a few highlights of his impact are:

- Honorary Doctorate at Aalborg University
- Distinguished Professor at RWTH Aachen University
- Awardee of an ERC Advanced Grant
- Member of the Academia Europaea
- Numerous keynote presentations at prestigious conferences: LICS, CAV, ATVA, SEFM, CONCUR, iFM, FMICS, VMCAI, FMWEEK, FMCO, FSEN, VMCAI, FMCO, TASE, FORMATS, ETAPS tutorial, and many more.
- PC member/chair of many prime conferences: SafeComp, CSL, LATA, PSI, FM, HSCC, CAV, ICALP, CONCUR, CAV, FORMATS, SEFM, TACAS, ATCA, CONCUR, MOVEP, ICALP, FM, and many more.
- Numerous scientific prizes: 2017 FAMOS, 2022 Concur Test-of-Time, 2023 Laprie Award
- 27.000 citations in total, H-index 75

Academic Impact: Joost-Pieter Katoen has pioneered **stochastic model checking**, a prominent subfield of Formal Methods concerned with analyzing systems with stochastic behavior. Applications range from robotics and cyberphysical systems to demographic models and systems biology: stochastic model checking techniques empower these fields with effective model techniques and efficient algorithms to analyze systems with stochastic behavior.

Professor Katoen has laid out the foundations of this field. He has developed the semantic foundations of various stochastic models and numerous foundational algorithms to analyse such models, ranging from very classical models like Markov chains to sophisticated models like stochastic games.

In 2016, his seminal paper, *Model-checking algorithms for continuous-time Markov chains* with Baier, Haverkort, and Hermanns, has been recognized as one of the most cited articles ever in Software Engineering. In 2023, this paper received the prestigious **Laprie Award** for influential influence on the theory and practice of Dependable Computing.

Furthermore, his book *Principles of Model Checking*, co-authored with Prof. Baier, has become the **standard reference textbook** for teaching the subject of model checking across the globe. It is the go-to compendium in the field, used by students, researchers and professionals worldwide.

More recently, Prof. Katoen has made fundamental contributions to **Probabilistic Programming**. This programming paradigm enables flexible and expressive statistical modelling in programming languages like Google's TensorFlow. Such languages are the key drivers in AI applications, deployed by Microsoft, Facebook, Uber AI, and many more. This approach is critical to verifying AI, i.e., providing hard guarantees (e.g., probability bounds) on the output of AI algorithms.

What distinguishes Prof. Katoen from fellow researchers across these scientific domains is the extreme scrutiny and dedication with which he develops his scientific agenda. This is especially visible in his orchestration of efforts to turn formal methods advances first into usable tool prototypes and then into widely applicable and usable software tools. This does not only pertain to the technologically most advanced stochastic model checker to date, STORM, or to SAFEST, the new analysis tool for probabilistic risk assessment, now commercialised professionally. It also encompasses the first ever stochastic model checker ETMCC, the first ever modelling and analysis toolset for stochastic timed automata MOTOR, the first ever tool for probabilistic loop invariants PRINSYS, the only toolset for correctness, modeling and performance of aerospace Systems, COMPASS, and many more. Looking at the depth and breadth of his contributions, Joost-Pieter Katoen is the leading European researcher in software tools for formal methods.

As a result, Katoen has an extremely strong track record in project acquisition. Apart from his **ERC Advanced Grant**, he has participated in several highly influential European research projects, is or was the spokesperson of the DFG-funded Graduate School UNRAVEL and AlgoSyn, has been a principal investigator of the **German Excellence Cluster UMIC**, and has contributed to or led another handful of German projects funded by DFG and the Federal Ministry of Education and Research.

Industrial Impact. Joost-Pieter Katoen has an impressive track record in the industrial application of stochastic models. He had intensive collaboration in the automotive domain with Ford on the formal verification of and code generation from Simulink models for next-generation Driveline State Requests and E-Clutch Control. With BMW, Professor Katoen collaborates on safety guarantees for vehicle guidance systems. In a project funded by Siemens, he successfully applied model-checking techniques to verify a Programmable Logic Controller code. Further international industrial cooperation partners include National Dutch Railroads, with work on reliability engineering, and Huawei, with work on base-station performance optimisation.

One of the highlights is the COMPASS toolset he developed as the leader of an international consortium that the European Space Agency ESA, Airbus Defence and Space and Thales Alenia funded. The COMPASS tool is now the standard equipment used by ESA to predict (and mitigate) failures for space missions.

Another notable development involves commercialising SAFEST tools, featuring a user-friendly interface for STORM, particularly in managing dynamic fault trees. STORM, an advanced model-checking tool created by Katoen's group, integrates stochastic model-checking algorithms. DGBtech,

a startup specializing in reliability engineering consulting, has successfully commercialized SAFEST. With offices in Pakistan, the USA, and Germany, DGBtech offers widespread accessibility to this innovative solution.

Services to the Formal Methods community. Katoen has served the Formal Methods community in numerous ways. Amongst others, he is a founding member of the IFIP Working Group 1.8 on Concurrency Theory and played a leading role in establishing the QEST conference, merging two separate communities working on similar topics into a thriving annual scientific event.

From 2015 to 2019 he has been the **President of the ETAPS** association and as such has been chairing the Steering Committee of the European Joint Conferences on Theory and Practice of Software (ETAPS). A significant achievement in that period is that Joost-Pieter Katoen has been in the driving seat for ETAPS to adopt **a golden open access policy** within the LNCS proceedings so that, since then, the results published at the ETAPS member conferences (TACAS, FOSSACS, FASE, ESOP) are available to anyone without any charges. Other conferences, such as FM, are by now also adopting this agreement.

Currently, Katoen chairs the steering committee of TACAS and the Conference Committee of the ACM Special Interest Group on Logic and Computation which organizes, among others, the LICS conference.

Talent development. Prof. Katoen has **strong personal leadership skills**. His research group at RWTH Aachen is a fabulous nursery for scientific talent. Many of his former PhD students have now positions at prestigious institutes, including Dr. Matthias Volk (TU Eindhoven, NL), dr Sebastian Junges (Radboud University, VENI talent award, best MSc thesis Germany), Prof. Benjamin Kaminski (Saarland University), Prof. Dino Distefano (Google & Queen Mary University of London), Prof. Nils Jansen (Bochum University; ERC laureate).

However, outside his group, professor Katoen is dedicated to developing the talents of other researchers. Over an extended period, he has **mentored** numerous young researchers. For his commitment to work-life balance, especially for young PhD students with children, he was awarded the 2017 **FAMOS Prize** by RWTH Aachen University.

All in all, these achievements make Joost-Pieter Katoen an outstanding recipient for the Formal Methods Europe Fellowship.

Sincerely yours,

Prof. dr. Marielle Stoelinga

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Prof. dr. Ed Brinksma

President Erasmus University, Rotterdam

Prof. Dr.-Ing. Holger Hermanns

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