

The Chair of Applied Dynamics in the Department of Mechanical Engineering at the Friedrich-Alexander-Universität Erlangen-Nürnberg, offers the following position, starting from April 1st, 2020 and limited for 36 months:

## Early stage researcher (THREAD ESR 10)

**on the Marie Curie ITN funded project**

**“Variational modelling and simulation of complex beams and their optimisation”**

**(full-time employment)**

The position is offered within the EU Marie Skłodowska-Curie Innovative Training Networks in the project “Joint Training on Numerical Modelling of Highly Flexible Structures for Industrial Applications [THREAD]”. The salary of the Marie Skłodowska-Curie Innovative Training Networks Fellowship (MSCA-ITN) follows the regulations set by the European Commission. The salary will include social security and will be composed of living, mobility and family allowances, where applicable, as outlined in the Grant Agreement and Horizon 2020 Marie Skłodowska-Curie Actions Work Programme, please see here: [http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-msca\\_en.pdf](http://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-msca_en.pdf)

### **background**

THREAD addresses the mechanical modelling, mathematical formulations and numerical methods for highly flexible slender structures like yarns, cables, hoses or ropes that are essential parts of high-performance engineering systems. The complex response of such structures in real operational conditions is far beyond the capabilities of current virtual prototyping tools. With 14 new PhD positions at 12 universities and research institutions in Austria, Belgium, Croatia, France, Germany, Norway, Slovenia and Spain, the project brings mechanical engineers and mathematicians together around major challenges in industrial applications and open-source simulation software development. It establishes an innovative modelling chain starting from detailed 3D modelling and experimental work to build validated 1D nonlinear rod models, which are then brought to a system-level simulation thanks to the outstanding numerical properties of the developed algorithms. This holistic approach combines advanced concepts in experimental and theoretical structural mechanics, non-smooth dynamics, computational geometry, discretisation methods and geometric numerical integration and will enable the next generation of virtual prototyping.

The current Early Stage Researcher PhD project (ESR) on variational modelling and simulation of complex beams and their optimisation will be supervised by Prof. Dr.-Ing. habil. Sigrid Leyendecker (Friedrich-Alexander-Universität Erlangen-Nürnberg). The ESR will develop a simulation model of the interaction of a beam, having a layered cross-section structure, with a surrounding that strongly limits its deformation. The workplace will be at the Chair of Applied Dynamics that is specialised in computational mechanics with focus on the development of efficient techniques for the simulation and optimisation of dynamical and control systems with applications to modern engineering and biomechanical questions (<http://www.ltd.tf.uni-erlangen.de>).

## necessary requirements

- M.Sc. / Dipl. (Univ.) in Mathematics, Computer Science, Computational Physics, Computational Engineering or related fields is preferred (all backgrounds are welcome to apply)
- experience in numerical software development is highly desirable
- experience in mathematical modelling with differential equations is desirable
- high standard of spoken and written English
- qualification as an “Early Stage Researcher“, i.e. at the time of appointment no doctoral degree and less than 4 years of research experience (full-time equivalent) after obtaining a degree that formally allows you to embark for a doctorate
- mobility requirement: at the time of appointment, an “Early Stage Researcher” must not have resided or carried out their main activity in Germany for more than 12 months in the 3 years immediately prior to their appointment
- for more details please see here: <https://thread-etn.eu/apply/>

## tasks

The ESR faces the challenging research question of the development of a variational formulation of the dynamics of a beam with a layered cross-section structure, that moves in and interacts with a narrow environment. A structure preserving space time discretisation guarantees a realistic simulation respecting the geometrical properties of the system, while adaptivity techniques enable an efficient simulation in practical relevant cases. Effective cross-section properties are obtained from multi-material layered models and also characterised experimentally. The structure is to be optimised with respect to its mechanical properties. Application in the simulation of medical device operation leads to a deepened understanding and eventually to an optimisation of the device and the process.

The ESR will join THREAD’ s comprehensive secondment programme including a three-month internship at the industrial partner KARL STORZ SE & Co.KG (Estonia) focussing on the endoscope modeling and three one-month secondments to Dr. Joachim Linn at Fraunhofer ITWM in Kaiserslautern (Germany) to learn about the experimental characterisation of effective properties, to Prof. Olivier Brüls at the University of Liège (Belgium) to get knowledge on non-smooth dynamics and to Prof. Elena Celledoni and Prof. Brynjulf Owren at the Norwegian Univeristy of Science and Technology in Trondheim (Norway) to learn about Lie-group integration methods, multi-Hamiltonian formulations and multiscale rod problems.

In its pursuit of academic excellence, FAU is committed to equality of opportunity and to a proactive and inclusive approach, which supports and encourages all under-represented groups, promotes an inclusive culture and values diversity. FAU is a family-friendly employer.

Please submit your full application dossier only in English until 15 January 2020. Applications must be submitted on the website <https://thread-etn.eu/apply/>. Applications must include a motivation letter tailored to the research project, the curriculum vitae (Europass format preferred), the digital copy of the highest academic degree (e.g. master) and the contact data of up to three scientific references. For queries about the research project please contact Prof. Dr.-Ing. habil. Sigrid Leyendecker, Email: [sigrid.leyendecker@fau.de](mailto:sigrid.leyendecker@fau.de). For queries about the European Training Network THREAD, please contact

the project coordinator at [coordination@thread-etn.eu](mailto:coordination@thread-etn.eu). The position is offered with reservation of possible budgetary restrictions. Application portfolios will not be returned, application costs will not be reimbursed.

### summary

- intended grouping depends on EU directives according a researcher
- fixed-term employment
- workable in part time (when in accordance with EU directives)
- proposed starting date April, 1st 2020
- deadline for application is January 15th, 2020