**4th Polish Congress of Mechanics & 23rd International Conference on Computer Methods in Mechanics**
**PCM-CMM-2019**
***September 8-12, 2019, Krakow, Poland***

# PARTICLE ACCELERATORS AND THERMONUCLEAR FUSION REACTORS – CHALLENGES IN MECHANICS AND MATERIALS RESEARCH

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## SUMMARY

Particle accelerators are now the basic tools in the research of fundamental laws of sub-atomic particle physics (High Energy Physics-HEP), but at the same time, at much smaller scale, they constitute novel and extremely powerful instruments of looking into materials structure at a sub-microscopic level, e.g. by means of synchrotron radiation or neutron spectroscopy. Recent biggest international projects, such as the Large Hadron Collider (LHC) and ITER have been possible only thanks to a worldwide collaborative effort and have required challenging developments and advances of many branches of science and technology. These advances also include several fields of mechanics, encompassing new theoretical developments, novel materials and experimental techniques as well as more efficient computational tools. Further developments in these fields are essential for planned potential new devices, such as the International Linear Collider (ILC) and the Future Circular Collider (FCC), or the thermonuclear fusion DEMOnstration Power Station (DEMO) and the DEMO Oriented Neutron Source (DONES). However, they are not restricted to the fundamental research in physics; indeed, there are now numerous projects and activities which use these developments in many applied research projects, including e.g. potential future Accelerator Driven Systems for sub-critical nuclear reactors, medical imaging and therapy, various applications of superconducting technology, synchrotron light and spallation sources facilities. This mini-symposium focuses, on one hand, on novel advances in mechanics developed due to HEP and thermonuclear fusion experiments, required by future projects, and, on the other hand, on the new possibilities offered by physics to probe deeper into the structure of materials. The topics invited for this mini-symposium cover (not exclusively):

- Thermo-mechanics of interaction of particle with matter,
- Materials testing and constitutive modeling for these applications, including dynamic loads, phase transformations and radiation damage,
- Constitutive modeling of superconducting materials and applications of superconductors,
- Materials research with new tools offered by accelerators and synchrotrons.