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# DEEP MACHINE LEARNING BASED SOLUTIONS FOR PARTIAL DIFFERENTIAL EQUATIONS TRACK NUMBER: 1700

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## ABSTRACT

Machine learning (ML) is useful achieve the enhanced computational power and flexibility by learning to represent a complex activity as a nested hierarchy of simple concepts. Physics informed neural networks can be trained to solve practical problems, satisfying any given law of physics described by general non-linear partial differential equations. Furthermore, multilayered artificial neural networks can be used to learn digitally from large datasets , a process known as deep learning (DL) [1, 2]. Therefore, with appropriate training, neural networks can be employed to efficiently solve complex engineering problems.

Deep machine learning (DML) based solutions of Partial Differential Equations (PDEs); especially for coupled problems, i.e. problems with high dimensionality are particularly important. Typically, FEM solutions become increasingly inefficient with increasing dimensionality. Here, DML based solutions seem to be a good alternative since their computational cost increases only slightly with dimensionality. Furthermore, the inverse analysis, e.g. for crack detection problems, of such problems becomes increasingly difficult. DML based solutions can treat forward and inverse problems in the same manner. The focus of this symposium will be on DML based solutions for PDEs and their applications. The applications are not limited, however, some are listed: coupled electro-mechanical problems, development of novel materials, optimised structural designs, topology optimisation, fracture mechanics, molecular dynamics simulations, to name a few.

## REFERENCES

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