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Original

Advanced finite elements and neural networks for scaled models / Carrera, E.; Iannotti, P.; Pagani, A.; Petrolo, M.. - ELETTRONICO. - (2022). ((Intervento presentato al convegno 9th International Symposium on Scale Modeling tenutosi a Napoli nel 2-4 March 2022.

Availability:

This version is available at: 11583/2957073 since: 2022-03-02T14:50:43Z

Publisher:

Kozo Saito, Sergio De Rosa, Yuji Nakamura

Published

DOI:

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ADVANCED FINITE ELEMENTS AND NEURAL NETWORKS FOR SCALED MODELS ANALYSIS

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This work proposes a hybrid approach based on finite element analysis and deep learning for predicting static and dynamic response of scaled models. The finite element models are built by using the Carrera Unified Formulation (CUF), according to which high order theory of structures can be implemented by expanding the primary unknowns with arbitrary cross-section or thickness functions, in the case of beams and plates/shells respectively. Sampled models are used for training neural networks, which are ultimately able to predict natural frequencies as well as stress states of structures subjected to different loadings and boundary conditions. Several problems are considered, including composite structures, for which refined layer-wise kinematics is demanded for providing accurate failure indexes. It is demonstrated that the proposed machine learning algorithms are able to predict the expected results in a very efficient manner once the main characteristics of the structure and the scaling parameters are known.