

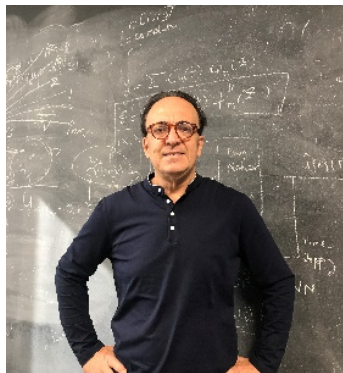


NATIONAL TECHNICAL UNIVERSITY OF ATHENS

The Rector of the National Technical University of Athens, Andreas G. Boudouvis, invites you to attend the following webinar organised on the initiative of the Institute for Structural Analysis and Antiseismic Research of the School of Civil Engineering at NTUA.

### Webinar

#### From Neural PDEs to Neural Operators: Blending data and physics for fast predictions



[George Em Karniadakis](#)

**The Charles Pitts Robinson and John Palmer Barstow Professor  
of Applied Mathematics and Engineering, Brown University, USA;  
Also @MIT & PNNL**

**Tuesday, 10 May 2022, 17:00 EEST**

Webex Webinar: <https://centralntua.webex.com/centralntua/j.php?MTID=mc9e71b5824c4ed7da4557d03a0f3ac57>  
NTUA youtube channel: [https://www.youtube.com/channel/UC-L-24Fk5qakf\\_TxDadKH8g](https://www.youtube.com/channel/UC-L-24Fk5qakf_TxDadKH8g) (live)

**Abstract:** We will review physics-informed neural network and summarize available extensions for applications in computational mechanics and beyond. We will also introduce new NNs that learn functionals and nonlinear operators from functions and corresponding responses for system identification. The universal approximation theorem of operators is suggestive of the potential of NNs in learning from scattered data any continuous operator or complex system. We first generalize the theorem to deep neural networks, and subsequently we apply it to design a new composite NN with small generalization error, the deep operator network (DeepONet), consisting of a NN for encoding the discrete input function space (branch net) and another NN for encoding the domain of the output functions (trunk net). We demonstrate that DeepONet can learn various explicit operators, e.g., integrals, Laplace transforms and fractional Laplacians, as well as implicit operators that represent deterministic and stochastic differential equations. More generally, DeepONet can learn multiscale operators spanning across many scales and trained by diverse sources of data simultaneously.