validity of the present approach in terms of through-the-thickness stress profiles. It is demonstrated that meshless methods can be considered for accurate analysis of nanoplates when complex geometries are analyzed as well as random location of the point collocations.

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abst. 170
Repository

Strong- and Weak-Form Physics Informed Neural Networks for the Analysis of Composite Plates and Shells

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This work deals with the development of computational models relying upon the Physics Informed Neural Networks (PINNs) along with Extreme Learning Machine (ELM). The framework allows boundary value problems of linear elasticity to be solved using a strong- or weak-form approach. Goal of this paper is presenting and comparing these two approaches when applied to composite plates and shells. For this purpose, the PINNs/ELM framework is developed in conjunction with a Carrera's Unified Formulation, which is capable of handling several kinematic theories, ranging from Equivalent Single Layer (ESL) to LayerWise (LW) within the same framework. The strong-form approach is developed by collocating the solution in a grid of points belonging to the domain. No mesh nor numerical integration are needed. At the same, results show that the accuracy of predictions can be improved if the approach is rephrased in a weak-form. With this purpose, a weak-form strategy is developed, where integration is carried out via Montecarlo integration, whereas essential conditions are imposed with a penalty approach. Results are encouraging and show a drastic improvement on the quality of the predicted displacement and stress field. Comparison between the two methods is presented and discussed, and the results are validated against finite element computations.

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abst. 171
Room 1
Tuesday
July 20
12h15

Mechanics of layered shale as Cosserat continua with dilatancy effects

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Dilatancy is of importance for understanding the micromechanical behavior of layered materials and rocks such as shale. These effects are due to the elastic interfaces among rock formations and particles. Most of the times such interfaces have a rough surface which generate dilatancy and bring volume variation to the overall solid. However, such important effect is generally neglected in numerical analysis of layered shale. The aim of the present work is to study the effect of dilatancy on layered shale when rough elastic interfaces are considered. Different sizes of shale blocks are presented by changing their aspect ratio. The stiffness properties of the rough interface can be obtained by employing a contact density model. Different roughness is defined for the interfaces to assess the effect of dilatancy by changing the contact density function. A homogenization procedure based on an energetic equivalence criterion is used to generate the constitutive parameters. The problem is solved by using a homogenized micropolar continuum which is discretized by means of a finite element implementation. This study shows the validity of the micropolar theory when considering rough micro-structure as well as the importance of dilatancy effect in modelling such continua

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