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RADIAL POINT INTERPOLATING MESHLESS METHODS FOR THE NONLINEAR STRUCTURAL ANALYSIS

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Presently, the most commonly used discrete numerical method is undoubtedly the finite element method (FEM). This numerical technique allows to solve efficiently complex structural problems, considering inelastic materials, large deformations, contact and discontinuous domains. However, the literature reports several other discrete numerical techniques, equally capable to solve such demanding problems. Meshless methods are a class of discrete numerical techniques, whose most attracting feature is its unique capability to discretize the problem domain using an unstructured mesh [1]. Since the beginning of the 1990's, several efficient meshless techniques were developed with the objective of improving the numerical analysis of structural problems. Nevertheless, those meshless approaches are fundamentally very dissimilar, leading to distinct numerical performances.
In this work, several nonlinear structural problems are solved using radial point interpolation meshless methods (RPIMs) [1]. As the literature shows, when compared with the FEM, this class of meshless methods allows to obtain smoother and much more accurate solutions. Such performance is essential for a competent nonlinear problems analysis. In this work, several nonlinear structural problems are analysed with RPIMs (such as elasto-plastic material problems, large deformations, contact and crack growth benchmark problems), demonstrating the efficiency and accuracy of RPIMs meshless methods in the computational simulation of complex structural problems.

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REFERENCES

[1] Belinha, J. (2014). Meshless Methods in Biomechanics - Bone Tissue Remodelling Analysis. (J. M. R. S. Tavares & R. M. Natal Jorge, Eds.) (Vol.16 ed., p. 320). Lecture Notes in Computational Vision and Biomechanics, Springer Netherlands. ISBN: 978-3-319-06400-0