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NUMERICAL MODELLING OF REINFORCED CONCRETE STRUCTURES UNDER IMPACT WITH A MIXED DISCRETE ELEMENT / FINITE ELEMENT APPROACH

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The talk is devoted to the modelling of reinforced concrete structures submitted to an impact of a soft missile. This kind of load leads to an important damage of the concrete and formation of large cracks or even fragmentation of the structure. Methods and tools to predict the behavior of reinforced concrete structures submitted to such loadings is one of the challenges of Civil Engineering. To this aim, we develop a mixed approach to model the reinforced concrete. We use the spherical discrete element method ([1,2]) to represent the concrete, the reinforcement bars are modelled with beam finite elements. We develop a specific model to represent the interaction between the steel and the concrete modelled in this way. In this model we take into account the relative normal and tangential displacement of the bars with respect to concrete. Orthogonally to the bar, our steel-concrete interface damages under the traction loading and plasticizes else. The tangential behavior of our model is inspired by the curve $\tau - \delta$ (interface shear stress – interface slip) obtained thanks to pull-out tests. Geometrically, this model links a spherical discrete element and a beam finite element together whether the distance between them is smaller than a specific one given by a criterion. This criterion and non linear parameters of our steel-concrete link model are determined by simulating pull-out tests. To conclude the talk we present simulations with this mixed approach of several reinforced concrete structures submitted to an impact.

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