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Penalty Approximation of Impact with Coulomb Friction

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Impact problems with Coulomb friction in a finite number of degrees of freedom are not yet completely understood from the mathematical point of view, and it is useful to possess a range of methods for the constuction of solutions. Moreau, Monteiro-Marques, Stewart used a time-stepping method in order to construct a solution. Here a penalty approximation is proposed; it is simpler than time-stepping, and it allows for more general friction cones and for more transparent mathematical proofs. The non interpenetration constraint is replaced by normal compliance approximation; it is not difficult to obtain estimates on the penalized equation. The passage to the limit on Coulomb's relation as the compliance tends to 0 seems to require the multiplication of Dirac masses by functions which are discontinuous at the coordinate of the Dirac masses. However, precise asymptotics of the approximating problem make it possible to find a relation in the limit between the tangential and normal components of the reaction.

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