Nonsmooth Problems with Applications in Mechanics
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Recent advances in the asymptotic analysis of contact problems for elastic shells

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Abstract: In recent years, considerable progress has been made in the mathematical analysis of elastic shells in contact mechanics (see for example [2, 3] and references therein). One of the most studied kinds of shells are the elastic elliptic membrane shells, an scenario where non trivial inextensional displacements do not exist (see [1]), i.e.:

$$V_0(\omega) := \{\boldsymbol{\eta} = (\eta_i) \in [H^1(\omega)]^3; \eta_i = 0 \text{ on } \partial\omega, \gamma_{\alpha\beta}(\boldsymbol{\eta}) = 0 \text{ in } \omega\} = \{\mathbf{0}\},$$

with $\omega \subset \mathbb{R}^2$ being the domain where it is defined a parametrization of the middle surface S of the shell, and $\gamma_{\alpha\beta}(\boldsymbol{\eta})$ denote the covariant components of the linearized change of metric tensor associated with a displacement field $\boldsymbol{\eta} = (\eta_i)$ of the surface S. Now, there is a wide range of situations where S cannot be assumed to be elliptic (just take for example a pipe), thus the need of availability of other shell models for contact problems. In this talk we will discuss recent advances in the asymptotic analysis of generalized membranes (where still $V_0(\omega) = \{\mathbf{0}\}$) and for the so-called flexural shells (where non trivial inextensional displacements do exist). We will analyze when these models are asymptotically equivalent to the corresponding Koiter's shells, as the thickness ε of the shell tends to zero. Further, it is common that frictional contact problems require taking into account tribological effects such as wear or adhesion. We will also briefly discuss recent progress in the asymptotic analysis of these kinds of contact problems for elastic elliptic membranes.

References

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[3] Piersanti P, *On the improved interior regularity of the solution of a second order elliptic boundary value problem modelling the displacement of a linearly elastic elliptic membrane shell subject to an obstacle.* Discrete Contin. Dyn. Syst., **42**(2), 1011–1037, 2022.