Mathematical analysis of an adhesive point submitted to an external force of bounded variation

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In the context of cellular motility [4, 3], we present a mathematical model of microscopic adhesion (at the scale of actin filaments). We are interested in the mathematical analysis of a single binding connected to the substrate and submitted to an external force $f \in \mathrm{BV}(0,T)$. Next, we prove existence and uniqueness of the solution and then, in the spirit of [2], its convergence to the solution to a macroscopic friction law, in this weaker framework. Furthermore, following ideas from [1], we present a comparison principle of an integral equation with a load $f \in \mathrm{BV}(0,T)$ and a constant density of linkages in time.

[1] V. Milišić, D. Oelz. *On the asymptotic regime of a model for friction mediated by transient elastic linkages.* J. Math. Pures Appl. (9), **96(5)**, 484–501, 2011. doi :10.1016/j.matpur.2011.03.005.

[2] V. Milišić, D. Oelz. *On a structured model for the load dependent reaction kinetics of transient elastic linkages.* SIAM J. Math. Anal., **47(3)**, 2104–2121, 2015. doi :10.1137/130947052.

[3] D. Oelz, C. Schmeiser. *Derivation of a model for symmetric lamellipodia with instantaneous cross-link turnover.* Archive for Rational Mechanics and Analysis, **198(3)**, 963–980, 2010. doi : 10.1007/s00205-010-0304-z.

[4] D. Oelz, C. Schmeiser, V. Small. *Modelling of the actin-cytoskeleton in symmetric lamellipodial fragments.* Cell Adhesion and Migration, **2**, 117–126, 2008.

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