# New results on the asymptotic behaviour of stresses near the tips of corners and cracks with spring boundary conditions

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There are many models of adhesively bonded joints depending on the aim of study and the considered length-scale, among other factors. One of the classical models of a thin adhesive layer is Winkler's elastic foundation. In this model a thin adhesive layer is modeled by a continuous distribution of elastic springs, providing a simple linear-elastic traction-separation constitutive law of the interface between the two adherends. The normal and shear stiffnesses of spring distribution can be defined in terms of Young's modulus, Poisson's ratio and the thickness of the adhesive layer by widely accepted formulas [1]. Although this is a commonly used classical model for cracks in an adhesive layer by using both beam and continuum solid mechanics models [1,2], there is only a little knowledge about the asymptotic solution at the tip of such cracks [3]. The aim of this work is to describe the asymptotic series that define the singular solutions in the neighbourhood of the apex of an isotropic linear elastic corner with spring boundary conditions. A crack propagating in a thin adhesive layer modeled by a spring distribution is considered as a special case of the above problem. In the deduction of such asymptotic series, the complex variable is used to propose suitable harmonic and biharmonic functions including both power and logarithmic terms. These series are composed by the main terms (solutions of homogeneous corner-BVPs) and the associated finite or infinite series of the so-called shadow terms (solutions of recursive systems of non-homogeneous corner-BVPs), see [4] for details. A computer algebra software is used to perform analytical operations as the complexity of terms in these series may increase with increasing order of terms. A few examples of the asymptotic series for corners and cracks are presented to illustrate the capabilities of this procedure. Main features of the singular stress states for cracks and corners with spring conditions are pointed out.

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