ISCM-14 April 3, 2003; Technion, Haifa

NUMERICAL STUDY OF DELAMINATION OF THIN ELASTIC FILMS ATTACHED TO A RIGID SUBSTRATE

L. Chernin and **K.Y. Volokh***

Faculty of Civil and Environmental Engineering

Technion – Israel Institute of Technology, Haifa 32000, Israel

(* E-mail: cvolokh@tx.technion.ac.il)

Summary A framework for modeling delamination of thin films is described that is based on introducing a cohesive layer at the interface between the thin film and substrate. The film is considered as an elastic beam where cross-sections remain straight and not perpendicular to the neutral axis after deformation. The cohesive layer of zero thickness is described by normal and tangent tractions and conjugate displacement jumps. An exponential constitutive law relating tractions and displacement jumps is considered for the cohesive layer. Within this formulation nucleation, propagation, and arrest of local delaminations – edge cracks and blisters – is a natural outcome of the theory. The latter is in contrast to the traditional approach of fracture mechanics where stress analysis is separated from a description of the actual process of material failure. Finite element analyses are carried out for the qualitative study of the influence of different parameters of thin films and cohesive layers as well as different loads on delamination behavior of the film-substrate system. Particularly, films with non-uniform distributions of thickness, thermal loads, and cohesive properties are considered.