

# Surface wrinkling in film/substrate bilayers: Influence of material inhomogeneity and anisotropy

Yang Liu<sup>1,2</sup>

<sup>1</sup> *Department of Mechanics, Tianjin University, Tianjin 300354, China*

<sup>2</sup> *Mathematical Institute, University of Oxford, Oxford, OX2 6GG, UK*

*E-mail: [tracy\\_liu@tju.edu.cn](mailto:tracy_liu@tju.edu.cn), [liuy3@maths.ox.ac.uk](mailto:liuy3@maths.ox.ac.uk)*

In this talk, we present some analytical results concerning the onset of surface wrinkling in compressed film/substrate bilayers. Two separated studies are explored, including a stiff film coated to a graded substrate and a nematic film coated to a homogeneous substrate. The former incorporates the effect of material inhomogeneity while the latter involves intrinsic anisotropy. To deal with the eigenvalue problem arising from the bifurcation analysis with modulus gradient, we apply the Wentzel-Kramers-Brillouin (WKB) method and acquire an explicit bifurcation condition in the short wave limit. For the nematic film bonded to a compliant substrate, we perform a bifurcation analysis by considering the incremental deformation of the director. In both cases, some asymptotic solutions of the critical buckling load and the critical wavy pattern are derived, from which the effect of modulus gradient and the director orientation on regulating surface wrinkling is unraveled. All asymptotic solutions are validated by the corresponding exact ones.