On singularities of the unsteady Prandtl's equations

Prandtl's equations arise in the description of boundary layers in fluid dynamics. Solutions might form singularities in finite time, with the first reliable numerical studies performed by Van Dommelen and Shen in the early eighties, and a rigorous proof done later in the nineties in the seminal work of E and Engquist in two dimensions. This singularity formation is intimately linked with a phenomenon: the separation of the boundary layer. The precise structure of the singularity has however not been confirmed yet mathematically. This talk will first describe the dynamics of the inviscid model. We will describe how to compute the maximal time of existence of a solution, study certain self-similar profiles, and show that one in particular gives rise to the generic formation of the van Dommelen and Shen singularity. Then, for the original viscous model, the second part of the talk will focus on the obtention of detailed asymptotics for the solution at a relevant particular location. This is a collaboration with T.-E. Ghoul, S. Ibrahim and N. Masmoudi.

Courant Institute, New York University, New York, United States of America
E-mail address: cc5687@nyu.edu