JOSÉ ANDRADE SOARES JR.
Instituto de Física, UFC

Título: Cracking urban mobility

Resumo:

Assessing the resilience of a road network is instrumental to improve existing infrastructures and design new ones. Here, we apply the optimal path crack model (OPC) to investigate the mobility of road networks and propose a new proxy for resilience of urban mobility. In contrast to static approaches, the OPC accounts for the dynamics of rerouting as a response to traffic jams. Precisely, one simulates a sequence of failures (cracks) at the most vulnerable segments of the optimal origin-destination paths that are capable of collapsing the system. Our results with synthetic and real road networks reveal that their levels of disorder, fractions of unidirectional segments and spatial correlations can drastically affect the vulnerability to traffic congestion. By applying the OPC to downtown Boston and Manhattan, we found that Boston is significantly more vulnerable than Manhattan. This is compatible with the fact that Boston heads the list of American metropolitan areas with the highest average time waste in traffic. Moreover, our analysis discloses that the origin of this difference comes from the intrinsic spatial correlations of each road network. Finally, we argue that, due to their global influence, the most important cracks identified with OPC can be used to pinpoint potential small rerouting and structural changes in road networks that are capable of substantially improving urban mobility.