A simple model for the self-organised evolution of road networks

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The high degree of universality in the geometric properties of urban road networks suggests that the growth of urbanised areas can be understood as by simple self-organisation mechanisms. In this work, we present a mathematical model that allows explaining the geometric features of urban road systems in terms of an evolving network whose dynamics is controlled by a simple two-step growth algorithm. The basic ingredients of this model are (i) the radial expansion of urbanised areas, which is triggered by a random site picking that corresponds to the planning of new spots of urbanisation, and (ii) the economically efficient establishment of new links perpendicular to existing roads, which represents the generation of necessary transportation and supply infrastructures. It is demonstrated that the geometric properties of the resulting road networks are in excellent agreement with corresponding empirical findings.