Abstract: Construction simulation, a fast-growing field, is the science of developing and experimenting with computer-based representations of construction systems to understand their underlying behavior. This paper provides a history of construction simulation theory, explores the CYCLONE modelling methodology and its major subsequent developments, examines the development of the Simphony.NET and COSYE modelling environments and their functionality as more generic simulation platforms, and reviews effective strategies for applying simulation in construction. A construction simulation case study is presented, which illustrates one successful approach for adopting simulation technology in the industry, and outlines the benefits to industry of integrating these technologies. The paper provides an overview of long-term simulation initiatives leading to the next generation of computer modelling systems for construction, where simulation plays an integral role in a futuristic vision of automated project planning and control.