The development of increasingly complex robots in recent years has been characterized by an extensive use of physics-based simulations for controller design and optimization. Today, a variety of open-source and commercial simulators exist for this purpose for mobile and industrial robots. However, existing simulation engines still lack support for the emerging class of tendon-driven robots. In this paper, an innovative simulation framework for the simulation of tendon-driven robots is presented. It consists of a generic physics simulator capable of utilizing CAD robot models and a set of additional tools for simulation control, data acquisition and system investigation. The framework software architecture has been designed using component-based development principles to facilitate the framework extension and customization. Furthermore, for inter-component communication, the operating-system and programming language independent Common Object Request Broker Architecture (CORBA) has been used which simplifies the integration of the framework into existing software environments.