People are able to update their sets of motor skills as they learn and practice new motions. Thus, the motion planning system adopted by people seems dynamic and expandable. It also seems that acquired motor skills can be generalized such that motions can be performed in novel situations. In line with this, the generalized motor program theory (Schmidt and Lee, 1999) states that given a particular physical/environmental need, a person performs movement by retrieving a relevant movement pattern from her memory and modifying it through parameterization to satisfy the need. Inspired by these motor program views on the planning of human movements, this paper presents a novel, memory-based human motion simulation system. The proposed motion simulation system consists of three components: a motion database (memory), a motion search method (retrieval), and a motion modification algorithm (generalization). The motion database is a model of the human memory of motor skills. It contains actual human motion data obtained from motion capture experiments. The motion database as a model of human memory is dynamic: New motions can be registered with additional motion capture experiments when necessary. Also existing motions can be deleted if found redundant. Each motion in the database is represented as a set of joint angle trajectories. A motion is also given a set of descriptive attributes, which include the characteristics of the performer (age, gender, anthropometry, etc.) and the task (initial and final hand positions, load weight, etc). Given an input simulation scenario, the most relevant motions to that scenario are found through the use of the motion search method. These relevant motions are termed root motions. The root motions are further analyzed by the motion structure analysis algorithm so that their fundamental structures of the motions are identified (Park et al., 2001). Finally, the root motions are modified to satisfy the newly given scenario by the motion modification algorithm (Park et al., 2000; Park et al., 2001). The proposed memory-based motion simulation approach has been implemented based on the HUMOSIM (Human Motion Simulation) motion databases at the University of Michigan. The strengths and limitations of the proposed approach are discussed in comparison with other existing motion simulation approaches.