DESCRIPTION. State the application's broad, long-term objectives and specific aims, making reference to the health relatedness of the project. Describe concisely the research design and methods for achieving these goals. Avoid summaries of past accomplishments and the use of the first person. This description is meant to serve as a succinct and accurate description of the proposed work when separated from the application. If the application is funded, this description, as is, will become public information. Therefore, do not include proprietary/confidential information. **DO NOT EXCEED THE SPACE PROVIDED.**

Mechanical loading, and especially dynamic loading, is be lieved to play a major role in degenerative joint diseases. Furthermore, motion (i.e., kinematics) and loading (i.e., contact stresses) often interact to influence disease progression. Thus, knowledge of in vivo joint motion and loading during functional activities could help address this clinically significant issue.

While dynamic imaging advances now permit accurate measur ement of in vivo joint kinematics, a non-invasive experimental approach does not exist for measuring in vivo joint loading. Consequently, computer simulations have been used to develop predictions given estimates of the muscle forces acting on the joint. However, current rigid body and deformable modeling approaches are not able to calculate accurate contact stress results during movement in critical joints such as the knee.

A logical solution to this problem is to incorporate defo rmable joint models into a larger rigid body dynamic model, thereby obtaining the advantages of both approaches. However, the computational cost of such a hybrid approach is currently a limiting factor. This project therefore proposes the development of a parallel-processing framework for studying human joint mechanics. The specific aims of the project are as follows:

(1) Create a dynamic musculoskeletal model with deformable knee joint contact. Deformable contact in the knee will be studied initially since the knee is the most commonly injured joint.

(2) Incorporate this model into a parallel-processing optimization framework. Parallel processing will used to reduce the computational time for predictive optimizations from weeks to a matter of hours.

(3) Evaluate the model's ability to predict experimental movement data. Pre-existing experimental movement data will be used to evaluate the model's ability to predict motion and ultimately joint contact stresses.

The resulting functional virtual human model can then be used for basic research and clinical applications.

PERFORMANCE SITE(S) *(organization, city, state)*

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KEY PERSONNEL. See instructions on Page 11. *Use continuation pages as needed* to provide the required information in the format shown below.

Name	Organization	Role on Project
Benjamin J. Fregly, Ph.D.	AeMES	Principal Investigator
Alan D. George, Ph.D.	ECE	Key Personnel