eleton. These signals are in the form of processed surface electromyography (sEMG) signals and detected by surface electrodes placed on the operator's skin. This configuration takes advantage of the electro-chemical-mechanical delay which inherently exists in the musculoskeletal system (between the time when the neural system activates the muscular system and the time when the muscles generate moments around the joints).

[0272] The myoprocessor includes a model of the human muscle running in real-time and in parallel to the physiological muscle. During the electro-chemical-mechanical time delay, the system gathers information regarding the physiological muscle's neural activation level based on processed sEMG signals, the join position, and angular velocity, and predicts, using the myoprocessor, the force to be generated by the muscle before physiological contraction occurs. By the time the human muscle contracts, the exoskeleton moves with the human in a synergistic fashion, allowing natural control of the exoskeleton as an extension of the operator's body. Rather than feeding back information to the user based on whatever information the user may be manipulating, the exoskeleton feeds force forward to move the device based on the myoprocessor.

[0273] The force applied to the user of the device represents feedback from a real or virtual scene. The force applied to the user serves to assist their movement or constrain their motion as directed by a physical therapy regimen or by elements in a real or virtual environment. Forces are applied to change or inform a user of information based on a real or virtual environment.

[0274] FIG. **14** illustrates a block diagram of a system according to one example. In the figure, the user is fitted with a wearable exoskeleton as described in this document. The exoskeleton includes sensors (or transducers) and number of powered limbs. The exoskeleton is coupled to an interface that receives sensor data corresponding to the joints on the limbs as well as sensor data from the user. The interface also provides driving signals to the actuators of the exoskeleton. The computer is coupled to the interface and provides a virtual reality environment, for example, or is controlled by an operator that implements a therapy regimen, for example. The computer is shown coupled to a network which allows communication with other systems. For example, a second user in a remote location can serve as a master or a slave and operate in conjunction with the user illustrated in the figure.

[0275] FIGS. **15**A and **15**B illustrate perspective views of a model human wearing an exoskeleton of the present subject matter.

[0276] FIGS. **16**A and **16**B illustrate two different perspective views of an exoskeleton where cables are removed from the power drive for the sake of image clarity. The exoskeleton illustration includes hand piece **130**, lower arm link **132**, circular bearing **134** for the lower arm, circular bearing **136** for the upper arm, upper arm link **138**, and actuators **140**. The figures also illustrate attachment bracket **206** (for attachment to a stable platform), and connecting link **204**.

[0277] The above description is intended to be illustrative, and not restrictive. For example, the above-described embodiments (or one or more aspects thereof) may be used in combination with each other. Other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein." Also, in the following claims, the terms "including" and "comprising" are open-ended, that is, a system, device, article, or process that includes elements in addition to those listed after such a term in a claim are still deemed to fall within the scope of that claim. Moreover, in the following claims, the terms "first,""second," and "third," etc. are used merely as labels, and are not intended to impose numerical requirements on their objects.

[0278] The Abstract is provided to comply with 37 C.F.R. §1.72(b), which requires that it allow the reader to quickly ascertain the nature of the technical disclosure. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims. Also, in the above Detailed Description, various features may be grouped together to streamline the disclosure. This should not be interpreted as intending that an unclaimed disclosed feature is essential to any claim. Rather, inventive subject matter may lie in less than all features of a particular disclosed embodiment. Thus, the following claims are hereby incorporated into the Detailed Description, with each claim standing on its own as a separate embodiment.

What is claimed is:

1. A system comprising:

an upper link member coupled to a support frame at a shoulder joint;

a lower link member coupled to the upper link member at an elbow joint;

a hand member coupled to the lower link member at a wrist joint;

a plurality of transducers affixed to at least one of the upper link member, the lower link member, and the hand member;

a driver coupled to the frame and at least one of the upper link member, the lower link member and the hand member and wherein the driver is configured to control at least one of position and velocity relative to the frame; and

a processor configured to execute instructions to control the driver based on a signal received from at least one transducer of the plurality of transducers; and

wherein the upper link member and the lower link member are configured for attachment to an arm of a user and wherein a rotation axis of each of the shoulder joint, the elbow joint and the wrist joint are aligned with corresponding axes of the user.

2. The system of claim 1 wherein the support frame includes at least one of a wheelchair and a stationary structure.

3. The system of claim 1 wherein at least one of the upper link member and the lower link member are aligned with a portion of the arm.