

# The Application of Implant Technology for Cybernetic Systems

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## Definition:

The theoretical study of communication and control processes in biological, mechanical, and electronic systems, especially the comparison of these processes in biological and artificial systems.

Intraneural interfaces allow selective recording and stimulation of nerve fibers. Microelectrode arrays distributed along fascicles of the mixed peripheral nerve gain

direct access to axons from various sense organs and enables a multichannel nerve interface.

A Radio link used to send signals to the apparatus used.

100 individual needle electrodes are surgically implanted in median fiber of left arm. An Incision is made at wrist and proximal to the wrist to insert the array of electrodes. An electrode passer inserted in both incisions and passed under the skin is used to slip the electrodes in place.

Neural signals associated with muscle contraction could be generated by finger movement and detected by the array.

Extracellular neural activity occurs below a frequency of 3.5kHz.

The hardware interface for the array implant amplified each channel using a fifth order Butterworth filter stage with a

Gain = 5000, Low Cutoff = 250Hz, High Cutoff = 7.5kHz.

The signal is digitized to 10 bit resolution for a radio link.

The prosthetic hand contains force and slip sensors in the fingers and palm.

Joint flexion sensors are used to allow adaptation of the grip and the force applied to the object to be modified.

Microprocessors are used to ensure lightest touch applied to prevent crushing or dropping.

The subject was able to grip an unseen object using the implant from a distance of the prosthetic arm. After 12 days of practice this action was perfected to a normal grip of an object.

A sequential state machine was implemented using the neural signal to halt the cycle at the intended action on the wheelchair. All other components of the wheelchair were normal.

The implantation did not result in infection or any perceivable loss of hand sensation or motion control. The implant was finally extracted because of mechanical fatigue of the percutaneous connection.

Further testing after extraction has not indicated any measurable long-term defects in the subject

## Sources

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