



## Movement Predictor for Real-Time Robotics Control

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**The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a more precise method for calculating the motion of jointed mechanisms by using differential equations.**

### Overview

Articulated mechanisms like robot arms can be understood as a set of rigid segments linked by joints. The motions of each joint are related in a type of movement chain. For example, a wrist joint may support a pivoting shoulder, which is connected to an elbow, which attaches to an arm holding a welding gun or other industrial tool.

The position of the arm and its tool may be calculated using standard trigonometric formulas applied to each joint angle in succession. However, controlling these appendages to take a desired location or orientation is known as the 'inverse kinematics problem,' and can be difficult for mechanisms with high dexterity. Challenges include checking calculations and practical implementation in software.

### The Invention

A UW-Madison researcher has developed a mathematical motion predictor for controlling and designing jointed mechanisms.

The predictor uses a system of differential equations describing the rate of change in each moving joint. These equations are solved by direct substitution of the variables with multiterm power series expressions. A linear relationship between coefficients of the same order can be established to form a system of independent and linearly related equations solvable by standard automatic techniques.

### Applications

- Robotic mechanisms and anthropomorphs
- Vehicle suspension systems
- Computer modeling
- Motion control systems

### Key Benefits

- Automatic and precise motion data
- Fast calculation of inverse kinematics
- Supports complex mechanisms
- System can be employed by a general user.

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