Teeraphong Trakoolchokumnuay 2009: Command Shaping Applied to Point-to-Point Motion of a One-link Flexible-Joint Robot. Master of Engineering (Mechanical Engineering), Major Field: Mechanical Engineering, Department of Mechanical Engineering. Thesis Advisor: Mr. Withit Chatlatanagulchai, Ph.D. 72 pages.

Joint flexibility is used to reduce damage from accidental collision. Actually, robot's joint has the flexibility from basic property of its material. The past research specified that ignorance of the joint flexibility during the design phase may damage joint due to resonance, and the control design has less efficiency. However, the control design of the flexible-joint robot is an open research problem because the mathematical model of the robot is complicated, and the flexible-joint robot is under-actuated. The robot cannot move too fast because of the residual vibration at the end point due to the joint flexibility. Traditional reference acceleration signal is a square wave, which has high power spectrum energy over a broad frequency range. When this reference acceleration is intergraded to become reference velocity and position, they also have high power spectrum energy over a broad frequency range. This high power spectrum signals, when used as reference signals, will excite the robot's natural frequency causing resonance.
In this research, we use a ramped sinusoidal basis function to reconstruct the reference signals to reduce power energy at the natural frequency and, therefore, reduce resonance. Simulation and experimental results show that the residual vibration of the flexible-joint robot using shaped reference signals is lower, and the flexible-joint robot achieves faster move time.

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