

Design of inherently dynamically balanced mechanisms and the study of the motion of masses with principal vectors.

For mechanisms that move at high speed dynamic balance is an important property to reduce base vibrations while for freely floating mechanisms such as humanoid robots dynamic balance helps for easy control and dynamic stability. Because of the accelerations of mass and inertia, unbalanced mechanisms exert reaction forces and reaction moments to their base. When designed dynamically balanced, these reaction forces and reaction moments are eliminated. This leads also to dynamic decoupling of the mechanism from its surrounding.

To obtain applicable dynamic balance solutions of mechanisms is a challenging problem. More often than not the balance solutions found for a certain mechanism turn out to not be possible in practice: too complex, too much additional mass and inertia. Instead of trying to balance pre-existing mechanisms, I have developed a reversed approach where balanced mechanisms are synthesized from inherently balanced linkage architectures. These are linkages that solely consist of the properties for balance. Mechanisms derived from these linkage architectures are inherently balanced too and the aim then has become to derive useful mechanisms for the intended task.

I will explain this approach, which is based on the 130 years old but almost forgotten method of principal vectors to describe the relative motion of masses, and show examples such as my high-speed balanced manipulator: <http://www.kineticart.nl/DUAL-V>.

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