Chair of Automatic Control

FAU

Announcement for Master Thesis

Modeling and Control of Strain Wave Gears

Motivation

Strain wave gears, also known as harmonic drive gears, are often used in robot joints due to their compact design and high gear ratio at the same time. Unfortunately, their dynamic behavior is highly nonlinear and difficult to model. In the literature, modeling approaches can be found that emulate this behavior but not in an accurate manner. Besides real life experiments, these models are still a helpful tool to study and explain the dynamical behavior of strain wave gears. Hence, these models need a closer investigation and perhaps extension. Usually when using the gear on a test bench, the input velocity and the output torque can be controlled. Complex scenarios for both input variables have to be realized to study the nonlinear behavior of the strain wave gears. A capable control of the system is necessary to apply these scenarios.

Figure 1: Source: https://www.schaeffler.de .

Task description

In a first step, two different models of a strain wave gear from literature should be compared and extended with additional states and physical effects. For better comparison, these gears should be exposed to complex load scenarios. Therefore in a second step, different control concepts for applying these scenarios shall be studied, for example disturbance variable connection, feed forward control and iterative learning control. Furthermore, the potential of observers shall be studied.

Requirements

Basic knowledge of MATLAB and control theory (e.g. having attended the courses Regelungstechnik A and B) is required.

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