Design of a Coupled Optical to Mechanical Alignment Device

Hendriks, Mark E.

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Department of Mechanical Engineering
Control Systems Technology Research Group

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Mark Erik Hendriks 1248979
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Supervisor:
ir. J.E.M Vrancken, TU/e
Andrew Pontuti, lead engineer at Brabant Engineering

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Abstract

Brabant Engineering is a multidisciplinary engineering company in Best that is active in the High-Tech sector. Brabant Engineering works for several clients. One of these clients is ASML, for whom concept work is carried out. A team within Brabant Engineering is working on concepts for ASML's new machines. One of the concept team's assignments is to develop an adjustment mechanism for the lasers in the laser adjustment compartment.

The laser adjustment compartment is hereinafter referred to as: 'the Assembly'. Currently, there is no adjustment mechanism for the laser(s) in the Assembly. So, an adjustment mechanism needs to be devised for the Assembly. This adjustment mechanism is the main focus of this research and is hereinafter referred to as: 'the Adjustment Mechanism'. The Adjustment Mechanism aligns the laser to get close to the preferred alignment.

With the Assembly, lasers in the system must be able to be accurately tuned to each other. It is also necessary for the lasers to follow the system even when the system is tilted. In order for the laser to follow the system, even when the system is tilted, it is necessary that the optical axis of the system follows the mechanical axis, when the mechanical axis is tilted. Therefore, the research statement for this report is:

Develop a means that lets the optical axis follow the mechanical axis, when the mechanical axis is tilted.

The final alignment of the laser has to be done manually by a very precise adjusting device. So, a manual adjusting device is part of the Adjustment Mechanism and is hereinafter referred to as: "Manual Adjustment Device".

To come up with a solution, first, the problem is analysed to get a better understanding of what the problem is and what components the mechanism consists of.

Based on the findings of the analysis three main functions are defined. The main functions are: transmission, rotation and actuation. In this report the focus is on the transmission mechanism and the rotation mechanism. The actuation of the system is considered but not further detailed. The ability to seal the complete mechanism is considered and detailed during the design process.

In transmission, it is rated to achieve a ratio of 2:1, where the angular rotation of the Adjustment Mirror must follow the movement of the Tube in the system. For the rotation, it is important that the rotation can be accurately adjusted to ensure a transmission ratio of 2:1 where parasitic movements should be minimized. For both the transmission function and the rotation function, three concepts are tested against three criteria: stiffness, clearance and accuracy.

Therefore, a preliminary design was developed, where the principle of a lever was used for the transmission function to achieve the transmission ratio of 2:1. To ensure the transmission ratio, cross-spring joints and struts are used to enable rotations, with the pivot points of the cross-spring joints and struts aligned to effectively minimize parasitic movements. After reviewing all criteria

on three concepts it turns out that the concept 'Level' fits the requirements the best.

It is recommended that a follow-up study continues with the design of a proper adjustment mechanism followed by analyses that can determine whether the system can achieve an eigenfrequency of 150 [Hz] on the Adjustment Mirror. Also further analysis will be required for a suitable design and production of the crossed spring flexures.