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Holistic Simulation - a modern approach to improve optical system design

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1. Holistic simulation

Today, performance quality is not the only criteria to convince the customer - product robustness, costs and time to market are at least as important. An innovative combination of simulation and optimization strategies is the key to overcome the challenges of successful product development of optomechanical systems. Therefore we promote an application-driven holistic approach for simulation, analysis and optimization of optical and optomechanical systems and technologies with the goal to provide CZ-wide highly-competitive tools, methods and system understanding to optimize the development process of optical systems and to improve product competitiveness of optical systems.

The specific know-how concerns an expert knowledge in optical system design and in modelling and simulation of optical and optomechanical effects. In addition, a detailed application-specific knowledge is essential.

Advantages of system development by improved simulation are

- More accurate performance prediction and better understanding of the whole system
- More specific formulation of performance criteria due to application
- Improved optimization
- Accelerated development time
- Finding conceptual drawbacks and problems in advance
- Cheaper and more robust products due to design to manufacture
- More systematic support of integration and assembly
- Robust system performance in specified environment

2. A successful example

The continuing trend towards higher integration density of microelectronic circuits requires steadily decreasing feature sizes. The SIA roadmap defines the technologies needed to meet this challenge. One of the fundamental requirements for lithography with a resolution of 50 nm and below is the development of new high-performance optical designs for projection lenses. Many sophisticated new design concepts have been created and further ideas are in the process of development. Optical designers continue to search for new ideas and suitable optical means to reduce residual



aberrations. The driving forces are decreasing wavelength and increasing numerical aperture, while the solution space is limited by several conflicting constraints such as diffraction limited performance, reasonable overall dimensions, minimum number of optical elements, availability of material, limits on the angles of incidence posed by coating properties and mechanical sensitivities, avoidance of vignetting, control of aspheric departure, etc... All these various effects has to be considered during the whole development and manufacturing process, initiating with the conceptual phase and continuing until product delivery, and actually until end of product life.

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