

Optomechatronic disk choppers with generalized window profiles: Ascertainment and multi-parameter analysis of non-linear transmission functions

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Abstract: Choppers are one of the most utilized devices in laser systems, almost as common as lenses, prisms, and filters. The most common configuration of optical choppers uses rotational disks with windows with linear margins (the classical chopper). We have developed and patented a novel configuration of disks, with windows with non-linear (e.g. semi-circular or elliptical) margins, in order to introduce supplemental parameters in the transmission functions of such devices. The non-linear profile of the laser impulses produced by such choppers can thus be designed, obtaining for example approximately triangular impulses (in contrast to classical chopper disks). We have proposed for such devices the name of eclipse choppers, due to the way they obscure the section of laser beam (in the plane of the disk), similarly to a planetary eclipse. In the present paper, we also introduce another configuration of disk choppers, that have linear margins (like classical choppers), but tilted with regard to the disk radius. This is a chopper with generalized window profile. A supplemental angular parameter — corresponding to the tilt of the linear margin of the window — is thus introduced. A multi-parameter analysis of these novel choppers is made, with regard to (positive and negative values of) such angles, but also with regard to the other geometric and kinematic parameters of the device. A comparison is finally completed between the possible non-linear profiles of the laser impulses produced by such generalized window profiles and those produced by classical, as well as by eclipse choppers.

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