COMPUTERIZED DESIGN METHOD FOR REFLECTOR SYSTEMS

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Abstract

The demand for concentrating light or thermal radiation, or for changing the path of a light beam according to a desired pattern arises in various engineering applications. Reflective type optical elements (mirrors) offer a cheap, lightweight solution for these tasks with a minimal loss of radiation energy. The traditional approach composes optical systems for a given application from mirrors of simple geometry (spherical, paraboloid or ellipsoid surfaces). In several applications image formation is not required; so non-imaging mirrors can be advantageously applied.

The computerized design program determines the path of rays and the intensity distribution on a receiving surface. The system can be composed of mirrors of arbitrary number and shape. The geometry of mirrors can be defined by closed form equations or by giving the supporting points of a spline function. Mirrors can have reflective properties on one or on both sides. Radiation sources can be modelled by defining a pure parallel beam of light, a single point source or a system of point sources. Real light sources like an electrical resistance IR heater can be described as a system of point sources. Each individual mirror has its own reflectance data during the intensity computation. The results for a two dimensional plane or axisymmetric configurations can be presented easily in graphical form.

The application of the method is illustrated by the examples of:

— pyrhliometer
— solar concentrator
— light guide
— IR line heater design.

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