RAY-TRACING TECHNIQUE FOR THE OPTIMISATION OF THERMAL RADIATION REFLECTORS

Viorel BADESCU[(1)], Bjarne ANDRESEN[(2)], Daniel GAMAN[(3)]
[(1)] Candida Oancea Institute, Faculty of Mechanical Engineering,
POLITEHNICA University of Bucharest, Spl. Independentei 313, Bucharest, ROMANIA
Email: badescu@theta.termo.pub.ro
[(2)] University of Copenhagen, DENMARK
[(3)] POLITEHNICA University of Bucharest, ROMANIA

ABSTRACT

This paper presents a 2-D ray-tracing procedure that can be used for the design of thermal radiation reflectors. The problem is defined as follows. A source of thermal radiation of arbitrary shape is placed in the concavity of a mirror. The radiation emitted by the source is reflected by the mirror and leaves the system through mirror's exit surface (in the 2-D geometry envisaged here the surface reduces to a line). The shape of the mirror should be designed in such a way that the radiation intensity on mirror's exit has a given distribution. The optimization technique is simulated annealing. Some details about the procedure and the computer code are also given.

REFERENCES

[1] SHATZ, N, BORTZ, J., "*An inverse engineering perspective on non-imaging optical design***"**, Proc SPIE, 2538, 1995, pag. 136-156
[2] RIES H, SHATZ N, BORTZ J, SPIRKL W, "*Performance limitations of rotationally symmetric non-imaging devices"*, J Opt Soc Am A, vol **14**(10), 1997, pag 2855-2862.
[3] VAZQUEZ-MONTIEL S, CORNEJO-RODRIGUEZ A, "*Design of astronomical telescopes of two mirrors using genetic algorithm in the stage of optimization***"**, Proc SPIE, 2730, 1996, pag 449-452
[4] CHEN X, YAMAMOTO K, "Genetic algorithm and its application in lens design**"**, Proc SPIE, 2863, 1996, pag 216-221
[5] BETENSKY E, "*Postmodern lens design***"**, Opt Eng, vol 32(8), 1993, pag 1750-1756
[6] VAN LEIJENHORST D.C., LUCASIUS C.B., THIJSSEN J.M., "*Optical design with the aid of a genetic algorithm*", BioSystems, vol 37, 1996, pag. 177-187
[7] RABINOVITCH K, TOKER C., *"Genetic algorithm and thin film design***"**, Proc SPIE, 2262, 1994, pag 163-174
[8] JI, J., ZHANG J., WANG, J., *"Binary optics design with genetic algorithm***"**, Proc SPIE, 2866, 1996, pag 116-119
[9] DOYLE S, CORCORAN D, CONNELL J, *"Automated mirror design using an evolution strategy"***,** Opt Eng, vol 38(2), 1999, pag. 323-333.
[10] SALAMON, P., NULTON J., ROBINSON J., PEDERSEN J.M., RUPPEINER G., LIAO L.**,** "*Simulated annealing with constant thermodynamic speed***"**, Comput. Phys. Commun, vol 49, 1988, pag 423.
[11] GAMAN D., ANDRESEN B., BADESCU V., "*Simulated annealing optimization of thermal radiation reflectors***"**, Confereinta a IX-a "Eficienta, confort, conservarea energiei si protectia mediului, 27-29 noiembrie 2002, Universitatea Tehnica de Constructii din Bucuresti, p. 129-136, Ed. MatrixRom, Bucuresti, 2003.