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Generalized Rabl mappings and Apollonius-type problems. (English) Zbl 1165.51012

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The cyclographic mapping, an indispensable tool in sphere geometry, assigns to each point $(x_1, \dots, x_{n-1}, r) \in \mathbb{R}^n$ the oriented $(n-2)$ -sphere with center (x_1, \dots, x_{n-1}) and signed radius r . A variant of this mapping, proposed by *K. Rabl* [*Elem. Math.* 29, 6–12 (1974; [Zbl 0271.55012](#))] for the case of $n = 3$, maps (x_1, \dots, x_{n-1}, r) to the non-oriented $(n-2)$ -sphere with center (x_1, \dots, x_{n-1}) and radius \sqrt{r} .

The authors use this generalized Rabl mapping for solving Apollonius-type problems in space: (a) Find a paraboloid of revolution tangent to two spheres in \mathbb{R}^3 , (b) find a quadric surface tangent to three spheres in \mathbb{R}^3 along circles.

The analogous problems in \mathbb{R}^2 are solved as well. Constructive solutions are based on methods from descriptive geometry of four-dimensional space or elementary projective geometry. For the spatial case, the authors provide some formulas.

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MSC:

[51N15](#) Projective analytic geometry

[51N05](#) Descriptive geometry

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cyclography; Rabl mapping; Apollonius-type problem

Software:

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