An optimization algorithm to be used in point-source corneal topographers is developed for the reconstruction of the topography of aspheric corneal surfaces. It is based on the damped leastsquares technique. The reconstructions obtained with a topographer comprising 48 or 90 point sources for corneas having different forms (spherical, conicoidal, complex) and apical radii (5–16 mm) were simulated numerically. Zernike polynomials up to the seventh radial order were used for the description of the shape of the anterior corneal surface. With no noise, i.e. uncertainty in the position of the image of each object point, it is shown that this approach allows reconstruction of the surface with a root-mean-square (RMS) error of <5 · 10^7 lm for the elevation map and 3 · 10^7 diopter for the refraction map. With noise, to get an averaged surface elevation RMS error of <1 lm, or an averaged refraction RMS error of <0.25 diopter, each spot must be located (in the image plane) with an error <1 lm.
Keywords: cornea, elevation map, least squares, point source, refraction map, topography.

Full article