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Inverse scattering analysis for perfectly conducting cylinders using a multifilament current model

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Abstract. A feasibility study is made of the multifilament current model approach as applied to the reconstruction problem of perfectly conducting cylinders, of a linear dimension comparable with the wavelength of the incident wave, from far-field scattering data. In each step of the proposed method, the given scattered field is approximated by the free-space fields of a set of fictitious electric current filaments, of yet to be determined amplitudes. The set of filaments is arranged on a contour similar in shape to the assumed shape of the scatterer, but reduced in scale. This contour can successively change places within the area where the scatterer is expected to be found. The inverse scattering process thus starts with an initial guess for the location of the filaments and determines their unknown amplitudes such that the field they produce approximates the given scattered field in the least-squares sense. The source contour is repeatedly shifted and the above amplitude determination is performed. The location-search procedure is terminated at the location where the field of the filaments best approximates the given scattered field. It is assumed that at this end location the filaments are located within the area originally occupied by the scatterer and that their fields resemble well not only the scattered far-zone field but also the near-zone one. At this stage, the field produced by the filaments and the incident field are summed up and the nodal line that corresponds to the scatterer surface is reconstructed. Two numerical examples are considered to support the suggested approach.