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Plane Wave Diffraction by a Truncated Elliptic Cylinder with a Strongly Elongated Cross-Section : Asymptotics of the Induced Current for Large Values of the Elongation Parameter

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General formulas for the asymptotic currents induced on a perfectly conducting elliptic cylinder, with a strongly elongated cross-section, illuminated by a plane wave propagating in the paraxial direction, have been published previously. The problem has been solved in [1] by applying the parabolic equation method to the Maxwell equations in elliptic coordinates. The final formulas for the induced current are given in terms of a new Fock function, expressed in the form of a rather complicated integral involving Whittaker and Gamma functions. In [2] it has been shown that for large values of the elongation parameter which corresponds to a non-elongated cross-section, the new Fock function reduces to the classical Fock function and is therefore uniformly valid.

When the elliptic cylinder is truncated by a plane perpendicular to its generatrixes, new formulas for the induced current in terms of a generalized Nicholson function which has also been expressed in the form of an integral of Whittaker and Gamma functions, were presented in [3].

In this paper, by expressing the Whittaker function via the Coulomb Wave function and its asymptotic form and by using the Stirling formula for the Gamma functions we derive the asymptotic form of the generalized Nicholson function for large values of the elongation parameter and show that it reduces to the classical Nicholson function given by an integral of the Airy function and its derivative. In addition, since the asymptotic current on the surface of the truncated elliptic cylinder is induced by the direct wave and the edge diffracted waves, it is shown that when the elongation parameter becomes large, the formula giving the total induced current reduces to the classical high frequency formula given in [4].

1. I. V. Andronov, “High frequency diffraction by an elliptic cylinder : the near field,” *Electromagn. Waves Appl.* 2014; **28**, pp. 2318-2326.

2. I. V. Andronov, and Yu. A. Lavrov, “Scattering by an elliptic cylinder with a strongly elongated cross-section,” *Acoustic Physics*, **61**, 4, 2015, pp. 383-287.

3. F. A. Molinet,, “Asymptotic Currents on an Elliptic Cylinder with a Truncated Strongly Elongated Cross-Section,” PIERS 2017, 22-25 May 2017, St Petersburg, Russia.

4. F. Molinet, I. .Andronov, and D. Bouche, “Asymptotic and Hybrid Methods in Electromagnetics,” *IEE Electromagnetic Waves Series* **51**, chap 4, 2005.