Boyd, J. P.
Asymptotic Chebyshev coefficients for two functions with very rapidly or very slowly divergent power series about one endpoint. (English) [Zbl 0857.42015]

Let $f(\varepsilon)$ be a divergent power series $f(\varepsilon) \sim \sum_{j=0}^{\infty} b_n \varepsilon^n$ with $b_n = o(n^{2G})$ where $G$ is the “Gevrey order” of the asymptotic series. The two cases when $G$ is infinite or zero are exemplified by functions

$$f_{\text{sub}}(\varepsilon) = \int_{0}^{\infty} \frac{dt}{(1 + \varepsilon t)} \quad \text{and} \quad f_{\text{sup}}(\varepsilon; A) = \sqrt{A} \int_{0}^{\infty} \frac{\exp(-A \log^2 t) \ dt}{1 + \varepsilon t}.$$

Asymptotic approximations for the coefficients of those functions are derived. They are limits with $r \to 0^+$ and $r \to 1^-$ of well-known asymptotics [see, for instance, G. Németh, Mathematical approximation of special functions: ten papers on Chebyshev expansions (Nova Science, New York) (1992), J. P. Boyd, Math. Comput. 39, 201-206 (1982; Zbl 0524.41014)]:

$$a_{\text{sub}}^n \sim (-\text{const} \ n \log^{1/2}(n)) \quad \text{and} \quad a_{\text{sup}}^n = o(\exp(-\text{const} \ n^r)) \quad \text{for any} \ r > 0.$$

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42C10 Fourier series in special orthogonal functions (Legendre polynomials, Walsh functions, etc.)

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