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Appendix

Fractional operators with approximately 2 dB error from $\omega = 10^{-2}$ to 10^{2} rad/sec

$\frac{1}{s^{0.1}} \approx \frac{220.4s^4 + 5004s^3 + 503s^2 + 234.5s + 0.484}{s^5 + 359.8s^4 + 5742s^3 + 4247s^2 + 147.7s + 0.2099}$
$\frac{1}{s^{0.2}} \approx \frac{60.95s^4 + 816.9s^3 + 582.8s^2 + 23.24s + 0.04934}{s^5 + 134s^4 + 956.5s^3 + 383.5s^2 + 8.953s + 0.01821}$
$\frac{1}{s^{0.3}} \approx \frac{23.76s^4 + 224.9s^3 + 129.1s^2 + 4.733s + 0.01052}{s^5 + 64.51s^4 + 252.2s^3 + 63.61s^2 + 1.104s + 0.002267}$
$\frac{1}{s^{0.4}} \approx \frac{25s^4 + 558.5s^3 + 664.2s^2 + 44.15s + 0.1562}{s^5 + 125.6s^4 + 840.6s^3 + 317.2s^2 + 7.428s + 0.02343}$
$\frac{1}{s^{0.5}} \approx \frac{15.97s^4 + 593.2s^3 + 1080s^2 + 135.4s + 1}{s^5 + 134.3s^4 + 1072s^3 + 543.4s^2 + 20.1s + 0.1259}$
$\frac{1}{s^{0.6}} \approx \frac{8.579s^4 + 255.6s^3 + 405.3s^2 + 35.93s + 0.1696}{s^5 + 94.22s^4 + 472.9s^3 + 134.8s^2 + 2.639s + 0.009882}$
$\frac{1}{s^{0.7}} \approx \frac{4.406s^4 + 177.6s^3 + 209.6s^2 + 9.179s + 0.0145}{s^5 + 88.12s^4 + 279.2s^3 + 33.3s^2 + 1.927s + 0.0002276}$
$\frac{1}{s^{0.8}} \approx \frac{5.235s^3 + 1453s^2 + 5306s + 254.9}{s^4 + 658.1s^3 + 5700s^2 + 658.2s + 1}$
$\frac{1}{s^{0.9}} \approx \frac{1.766s^2 + 38.27s + 4.914}{s^3 + 36.15s^2 + 7.789s + 0.01}$

Paper List

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