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Use Laplace transform method to solve

$$\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial u}{\partial r}\right)+\frac{\partial^2 u}{\partial z^2}=0,\quad 0<r<a,\ 0<z$$

with the following conditions

$$u(r,0)=1,\quad u(a,z)=0,$$

$$\lim_{z\to\infty}|u(r,z)|<\infty,$$

$$\lim_{r\to 0}|u(r,z)|<\infty.$$