

PDE solution flow charts

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Started to make flow charts for solving PDE's. In progress...

1 Heat PDE

Simplified the original chart, which was getting too complicated, to the following one

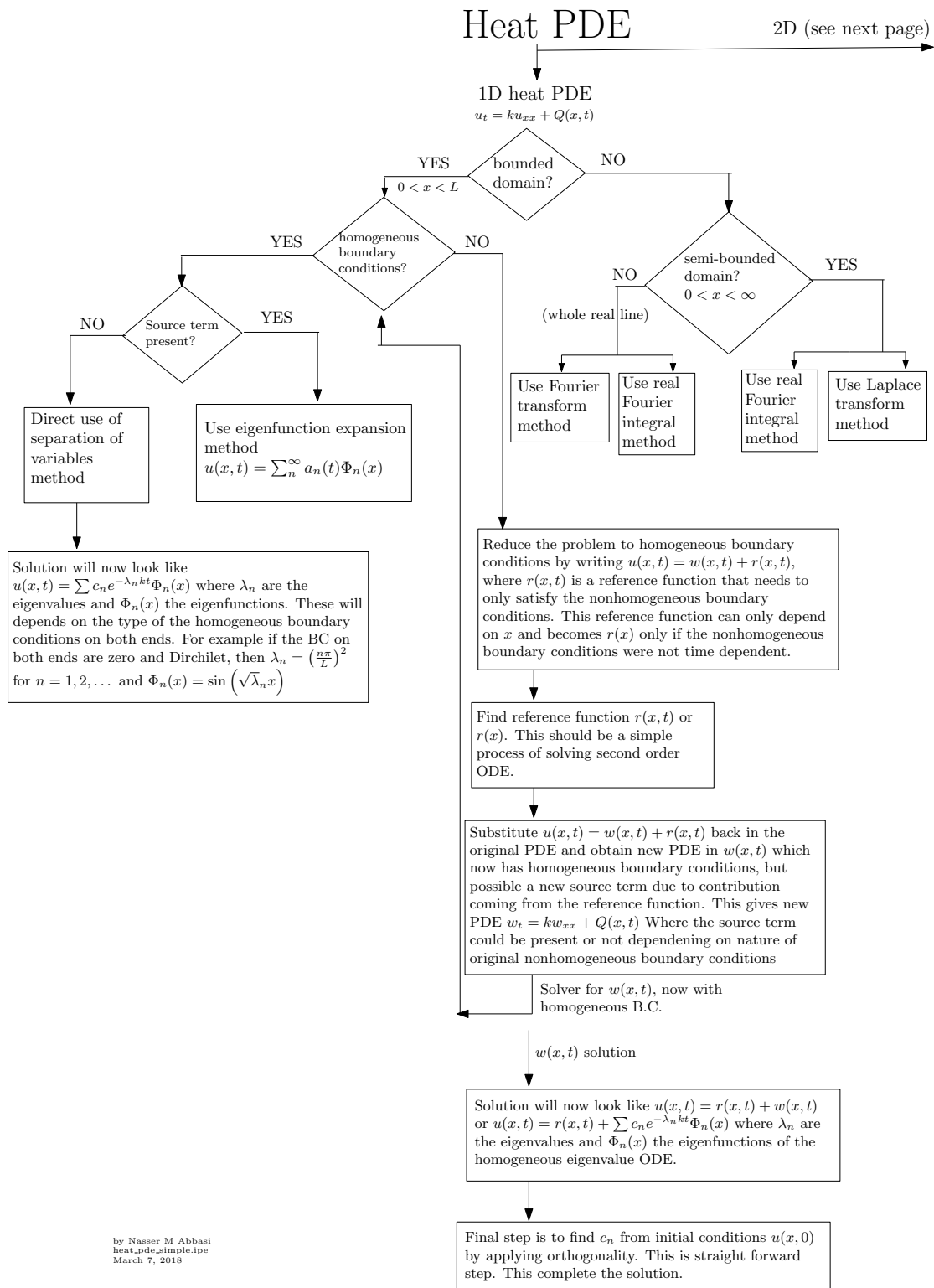
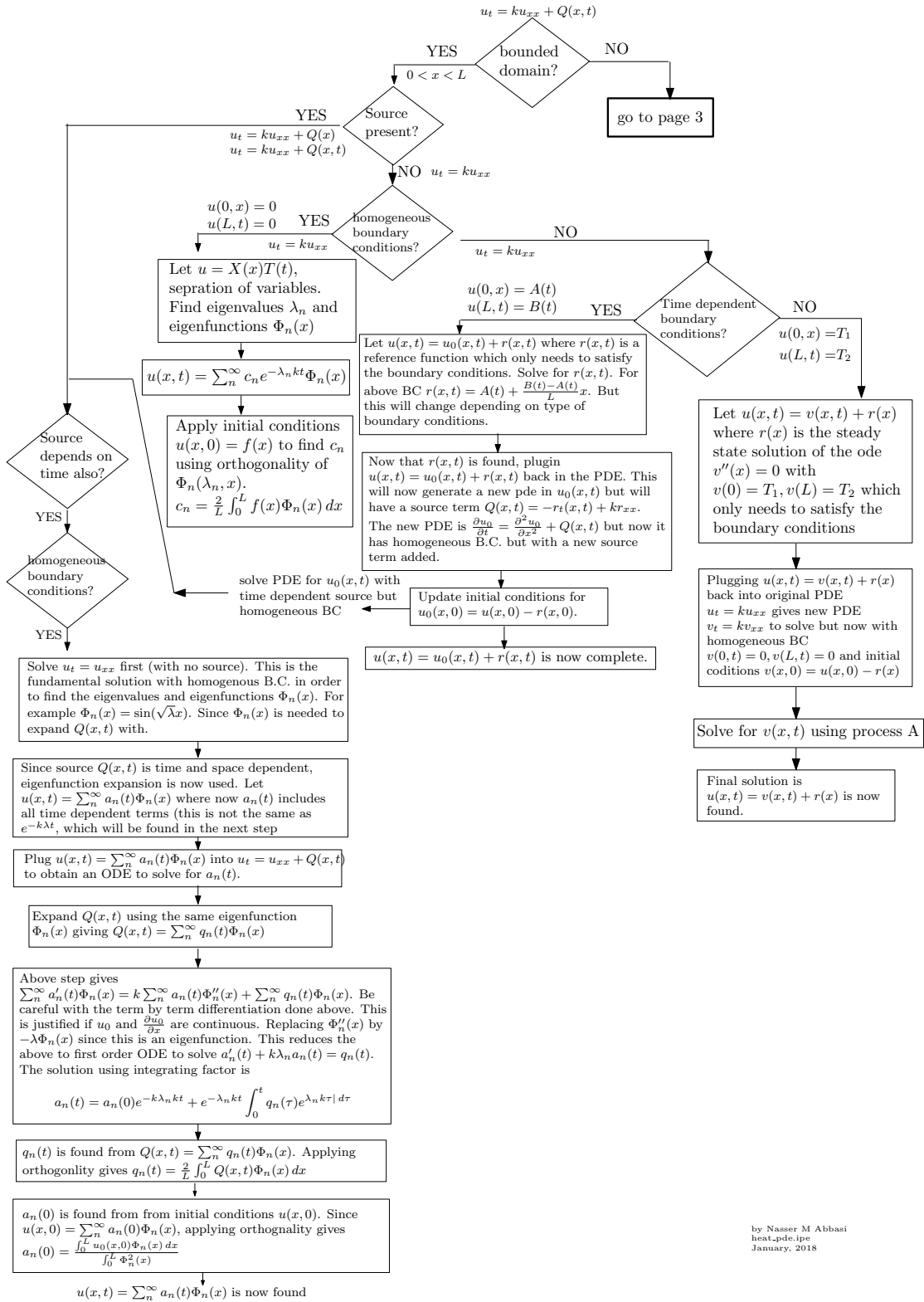


Figure 1: heat PDE flow chart

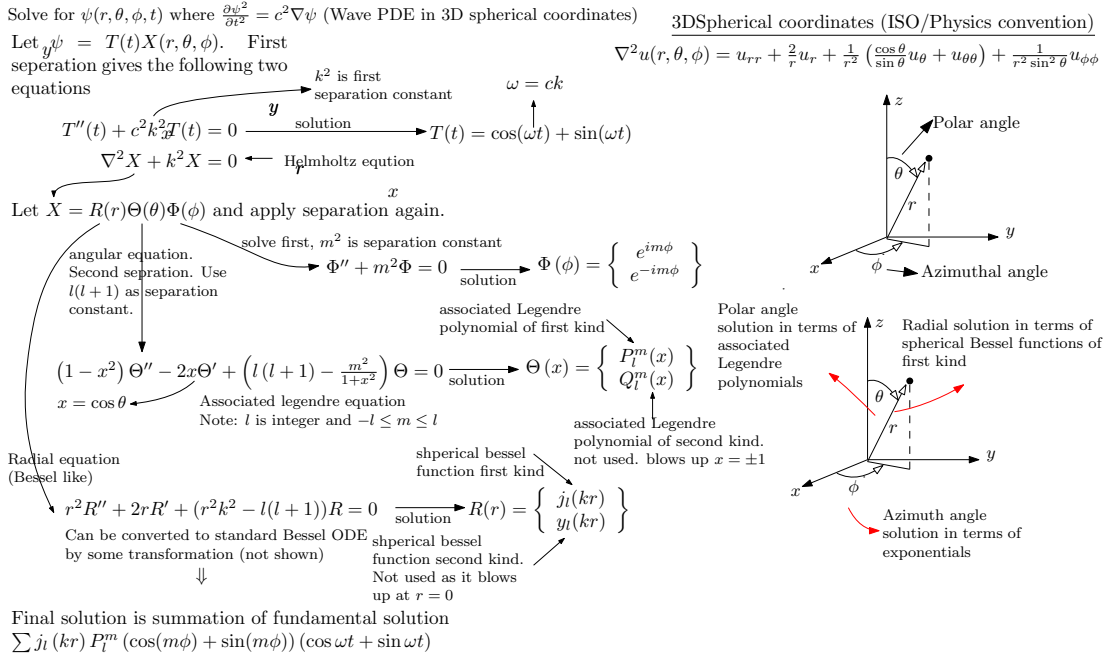
I have kept the first chart below for reference, but the above one is much simpler.



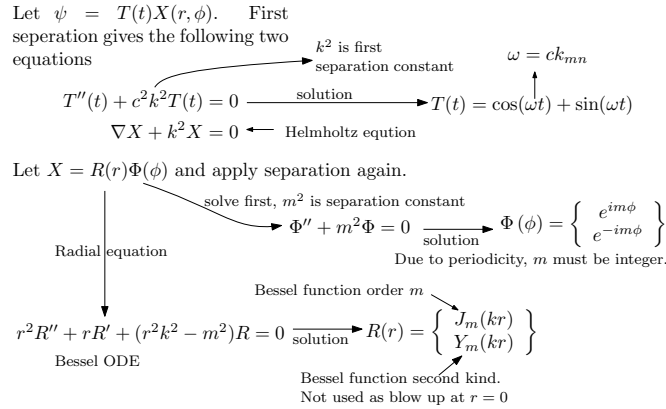
by Nasser M Abbasi
heat_pde.ipe
January, 2018

Figure 2: original heat PDE flow chart

2 Wave PDE

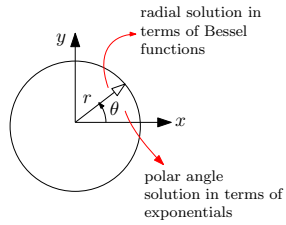


Solve for $\psi(r, \phi, t)$ where $\frac{\partial^2 \psi}{\partial t^2} = c^2 \nabla^2 \psi$ (Wave PDE in 2D disk, polar coordinates).
Membrane is fixed on edge of disk. Radius a .



2D polar coordinates

$\nabla^2 u = u_{rr} + \frac{1}{r}u_r + \frac{1}{r^2}u_{\theta\theta}$



$J_m(ka) = 0$ from boundary conditions. This fixes k . Let Z_{mn} be the n^{th} zero of the Bessel J_m function. Therefore $k_{mn} = \frac{Z_{mn}}{a}$ are allowed values of k .
 $\psi \propto J_m(k_{mn}r) (\cos(m\phi) + \sin(m\phi))$ This gives rise to modal shapes
 $\psi(r, \phi, t) = \sum J_m(k_{mn}r) (\cos(m\phi) + \sin(m\phi)) (\cos(ck_{mn}t) + \sin(ck_{mn}t))$

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Figure 3: Wave PDE flow chart