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ME685 Quiz 2

(1)

$$\frac{d^3y}{dx^3} + \frac{n+1}{2} y \frac{d^2y}{dx^2} - n\left(\frac{dy}{dx}\right)^2 + n = 0$$

BC : $y(0) = y'(0) = 0$

$\lim_{x\to\infty} y'(x) = 1$

Let $\frac{dy}{dx} = u$ & $\frac{d^2y}{dx^2} = w$

$\Rightarrow$ ~~$z'' + \frac{n+1}{2} y z' - nz^2 + n = 0$~~

~~$y(0) = 0$~~

~~$z(0) = 0$~~

~~$\lim_{x\to\infty} z = 1$~~

$\therefore$ $y = y$

$y' = u$ Converts BVP to IVP

$y'' = w$

$$\boxed{\begin{aligned} &\therefore\ y' = u \quad (1) \\ &u' = w \quad (2) \\ &w' + \frac{n+1}{2} y w - n u^2 + n = 0 \quad (3) \\ &y(0) = 0 \\ &u(0) = 0 \\ &\lim_{x\to\infty} u(x) = 1 \end{aligned}}$$

Converts IVP to BVP

Guess ~~a~~ a & b, as Initial condition for w.

~~and solve~~

$$w(0) = a$$
$$w(0) = b$$

~~using RK 4~~

Using these as initial values, solve the system of 3 equations, with RK 4

We check for various l by applying shooting method such that

$$\lim_{x \to l} u(l) = 1 .$$

Shooting Method

Say for $w(0) = a$, we get $u(l) = \alpha$

" " $w(0) = b$, we get $u(l) = \beta$

setting $w(0) = \frac{a+b}{2}$, we get $u(l) = \gamma$

For $(\gamma - \alpha)(\gamma - \beta) < 0$ [γ lying in mid-point of α & β]

if $(\gamma - 1)(\alpha - 1) > 0$

then $\alpha = \gamma$.

else

$\beta = \gamma$

repeat till γ is close to 1.