

Reunião de Orientação 06

Igor Pires dos Santos

igor.pires@ice.ufjf.br

Orientador: Rafael Bonfim



Programa de Pós-Graduação em Modelagem Computacional
Universidade Federal de Juiz de Fora

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Introdução

Modelo Matemático

Modelo Computacional

Resultados

Dissertação

Cronograma

- ▶ A construção de modelos de árvores arteriais é importante para a realização de estudos hemodinâmicos. Neste trabalho, apresentam-se:
- ▶ (i) um esquema analítico para o cálculo das características locais das ondas de fluxo e pressão em modelos de árvores arteriais 1D
- ▶ (ii) um ambiente computacional desenvolvido para a simulação e visualização dos resultados no tocante à construção de modelos e estudos hemodinâmicos. Os resultados obtidos neste trabalho estão condizentes com dados numéricos relatados na literatura.

- ▶ **Árvore proposta**
- ▶ Árvore extraída do artigo Duan & Zamir.

- ▶ **Duan & Zamir**
- ▶ 2 Artérias terminais.
- ▶ 6 segmentos totais (2 pares idênticos).
- ▶ Considerando o caso não-viscoso e $\phi = 0$
- ▶ Fase um (7 variáveis) + Fase Dois (5 variáveis)

▶ Parâmetros de Entrada

$(r(\text{cm}), L(\text{cm}), \rho(\text{g}/\text{cm}^3), E(\text{g}/\text{cm} * \text{s}^2), f(\text{Hz}), \epsilon, \mu_0, \phi_0)$

▶ $f = 3.65\text{Hz}$.

0 = $(r = 0.65), (L = 25), (\rho = 0.96)$ e $(E = 4.8 * 10^6)$.

1 = $(r = 0.45), (L = 11), (\rho = 1.134)$ e $(E = 10^7)$.

2 = $(r = 0.3), (L = 12), (\rho = 1.172)$ e $(E = 10^7)$.

3 = $(r = 0.2), (L = 10), (\rho = 1.235)$ e $(E = 10^7)$.

► $h = 0.1 * r.$

► $C = \sqrt{\frac{Eh}{\rho 2r}}.$

► $\omega = 2\pi f.$

► $\beta = \omega \frac{L}{c}.$

► $Y = \frac{\pi r^2}{\rho c}.$

- ▶ **Ângulo do fase:**
- ▶ $E_c = \|E_c\| \exp\{i\phi\}.$
- ▶ $\phi = \phi_0(1 - \exp\{-w\}).$

► **Viscoso:**

► $c_v = c\sqrt{\epsilon}.$

► $Y_v = Y\sqrt{\epsilon}.$

► $\alpha = R\sqrt{\frac{\omega\rho}{\mu}}.$

► $\phi = \phi_0(1 - \exp\{-w\}).$

► $\epsilon = 1 - F_{10}(\alpha).$

► $F_{10}(\alpha) = \frac{2J_1(i^{\frac{3}{2}}\alpha)}{\alpha i^{\frac{3}{2}}J_0(i^{\frac{3}{2}}\alpha)}.$

► **Reflection Coefficient «complex» e Admittance «complex»**

► Se folha $R = 0$, então $R = \frac{Y - (Y_{e_r} + Y_{e_l})}{Y + (Y_{e_r} + Y_{e_l})}$.

► Se folha $Y_e = Y$, então $Y_e = Y * \frac{(1 - R \exp\{-2i\beta\})}{(1 + R \exp\{-2i\beta\})}$.

► **Medium Pressure «complex»**

► Se raiz $\bar{P} = \bar{P}_0$, então $\bar{P} = \bar{P}_f * \frac{((1 + R_f) \exp\{-i\beta_f\})}{(1 + R \exp\{-2i\beta\})}$.

► **Pressure «complex»**

► $P = \bar{P} * (\exp\{-i\beta X\} + R \exp\{-i2\beta\} \exp\{i\beta X\}).$

► $\bar{P} = \frac{\bar{p}}{\bar{p}_0}$ e $\bar{p}_0 = 1$

► $P = \frac{p}{p_0}$ e $p_0 = \bar{p}_0 \exp\{i\omega t\}$

► **Flow «complex»**

► $Q = M\bar{P} * (\exp\{-i\beta X\} - R \exp\{-i2\beta\} \exp\{i\beta X\}).$

► $M = \frac{Y}{Y_r}$

► $Q = \frac{q}{q_0}$

► $q_0 = Y_r * p_0$

► **Flow «complex»**

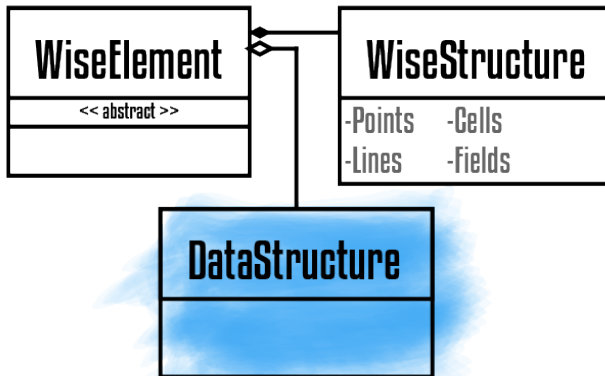
► $\frac{q}{q_0} = M\bar{P} * (\exp\{-i\beta X\} - R \exp\{i\beta(X - 2)\}).$

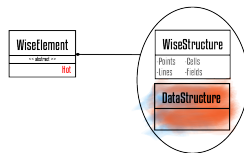
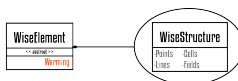
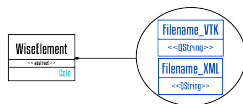
► $q = M'\bar{P} * (\exp\{-i\beta X\} - R \exp\{i\beta(X - 2)\}).$

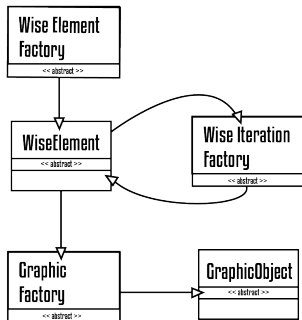
► $M' = \frac{Y}{Y_r} * Y_r * p_0 = Y * p_0$

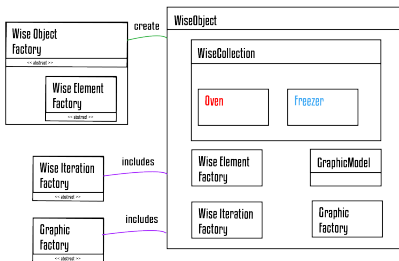
► $p_0 = \bar{p}_0 \exp\{i\omega t\}$

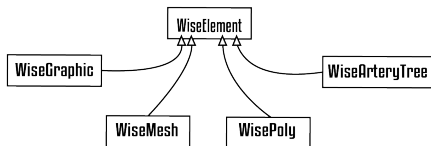
► $p_0 = 1 \text{ com } t = 0$

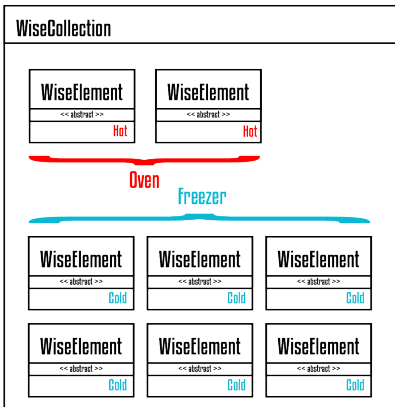




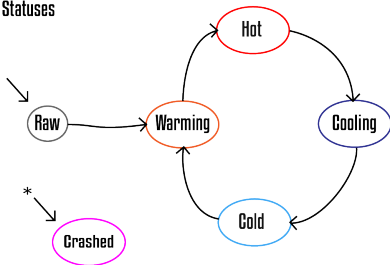




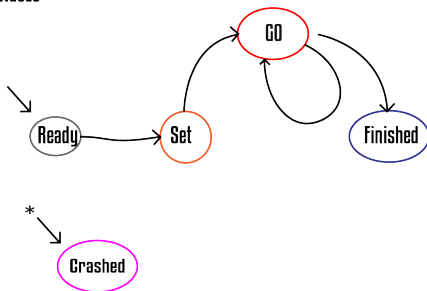


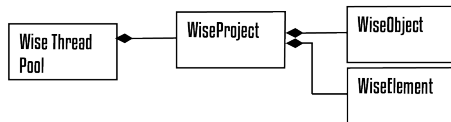


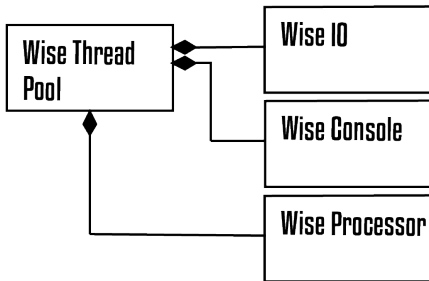
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Statuses

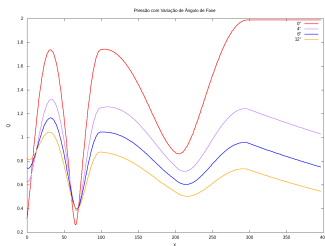
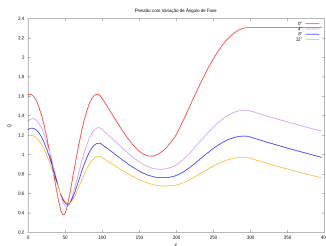
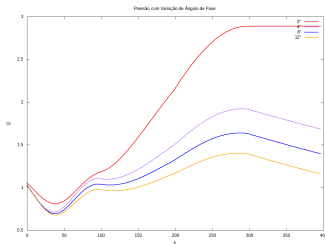
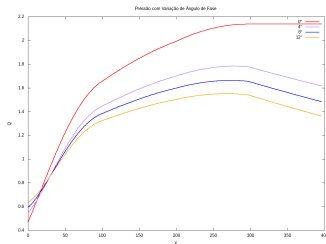


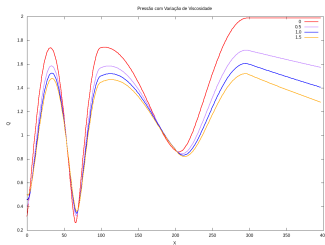
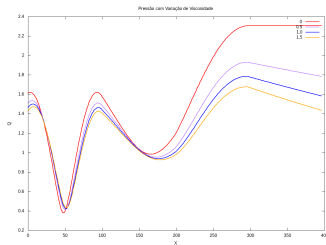
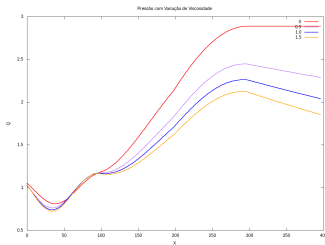
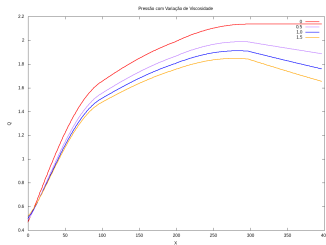
WiseObject
Statuses

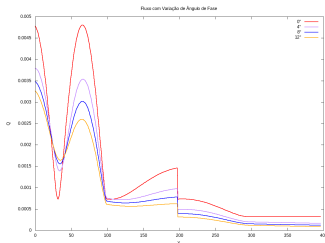
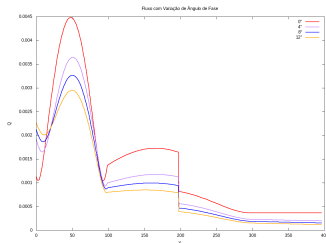
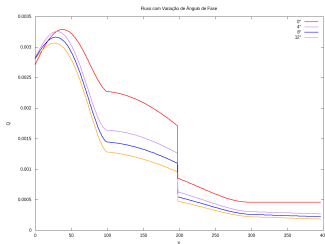
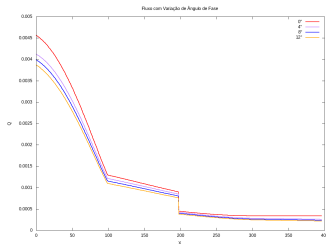


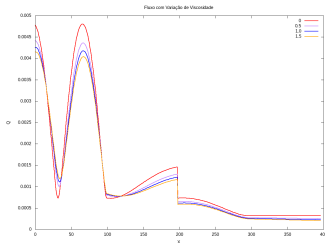
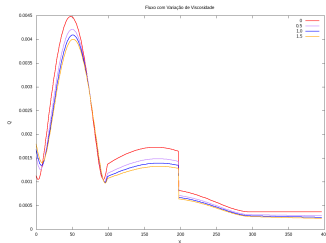
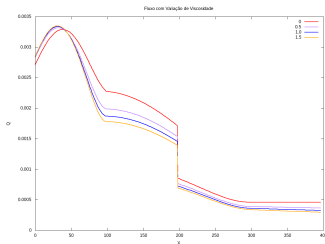
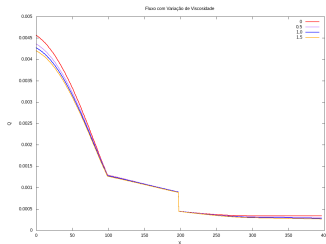












- ▶ Ferramenta Computacional
- ▶ Estrutura de dados
- ▶ (Sinais e slots, paralelização)
- ▶ Lista de comandos
- ▶ Interface gráfica
- ▶ Resultados
- ▶ Fluxo
- ▶ Pressão
- ▶ Conclusão

- ▶ Mar: Ajustes dissertação + Fim da dissertação
- ▶ Abr: Ajustes finais
- ▶ Mai: Ajustes finais