The Riera Curve

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Outline

- Approach and Iterative Algorithm
- Example: F4 Aircraft Impact
- Advantages
- Boeing 767 – Riera Curve
Riera Approach (1968)

\[ M_a = m \cdot v \]

\[ M_b = (m - dm)(v - dv) + (dm \cdot v_r) \]

\[ F = \frac{m \cdot dv}{dt} + \frac{(v - v_r) \cdot dm}{dt} \]

\[ F = P_c + \mu \cdot v^2 \]
Riera Iterative Algorithm

\[ t_{i+1} = t_i + \Delta t \]
\[ x_{i+1} = x_i + v_i \Delta t \]
\[ m_{i+1} = m_i - \mu_i v_i \Delta t \]
\[ v_{i+1} = v_i + \Delta v \]
\[ F_{i+1} = P_{c_{i+1}} + \mu_{i+1} v^2_{i+1} \]

Assumptions

\[ \Delta v = -P_{c_i} \cdot \frac{\Delta t}{m_i} \]
\[ P_{c_i} = \sigma_y \cdot A_i \]
F4 Aircraft Impact (Test Set-Up)

- Phantom F4 aircraft
- Target

\[
\begin{align*}
\text{Mass}_{\text{F4}} &= 14.2 \text{ t} \\
\text{Mass}_{\text{Fuel}} &= 4.8 \text{ t} \\
\text{Mass}_{\text{Impact}} &= 19.0 \text{ t} \\
\text{Mass}_{\text{Target}} &= 469.0 \text{ t} \\
\end{align*}
\]

\[v_{\text{impact}} = 215 \text{ m/sec}\]
Test Procedure
Mass-Distribution - F4 Aircraft

- F4+Fluid (Test)
- Fluid (Test)
- F4+Fluid (Simulation)
- Fluid (Simulation)
Crushing Force $P_c$ - F4 Aircraft

![Graph showing crushing force $P_c$ vs distance for F4 Aircraft](#)

- Test Data (F4-Aircraft)
- 50% Py
Impact Velocity - F4 Aircraft

Test Data (F4-Aircraft)
Riera Curve
Riera Curve – F4 Aircraft Impact

![Graph showing the impact force over time for F4 aircraft and the Riera curve.](image-url)
Advantages of Riera Approach

Estimation of

✓ Mass Distribution ($\mu$) vs. Crushing Force ($P_c$)
✓ Velocity and Force Distribution during Impact
✓ Impact Damage w/o detailed aircraft model

Aircraft Model Reduction using Riera Curve
Riera Curve – Boeing 767
Questions

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