國震中心台南實驗室開幕啟用研究合作專家學者論壇
NCREE Tainan Laboratory Grand Opening Forum

Impact of Near-Fault Ground Motions on the Efficiency of Viscous Damping Systems

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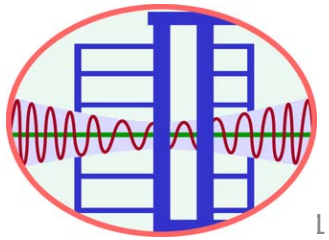
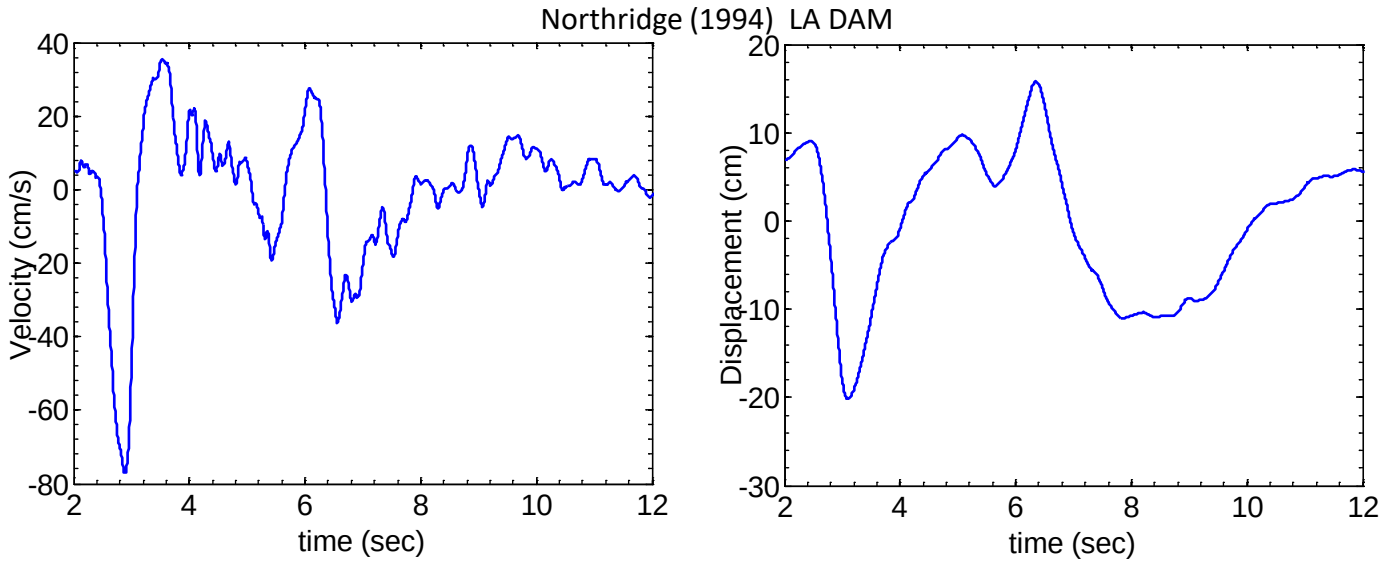


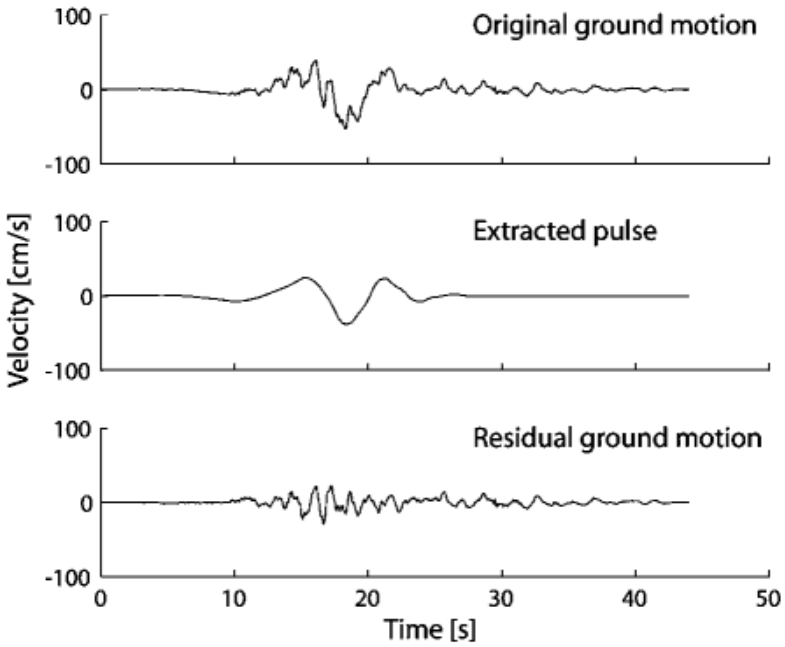
Near-fault effect

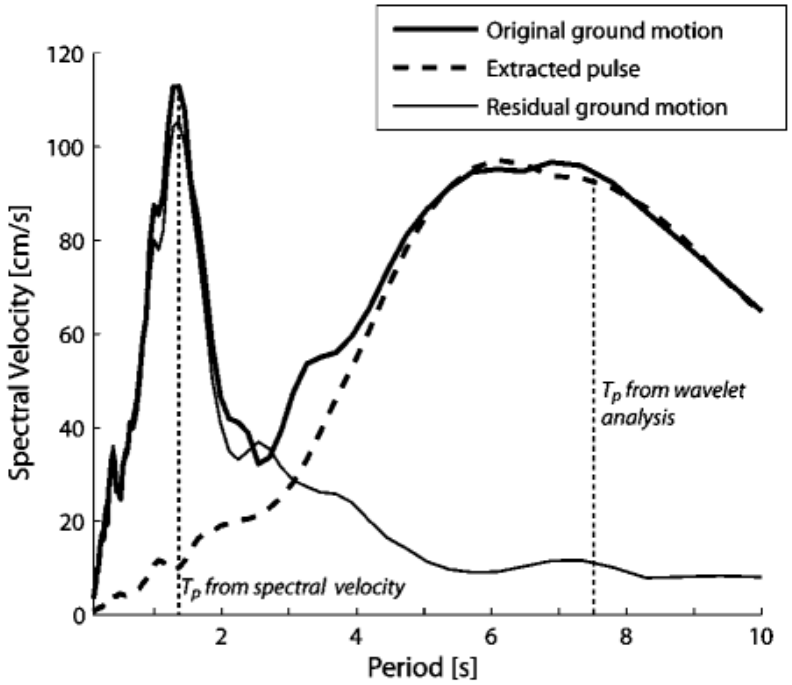
- Pulse-like ground motion
- Large velocity
- Permanent displacements



Spectral velocity of a sample NF record

- Baker (2007)
- Yermo Fire Station, the 1992 Landers Earthquake

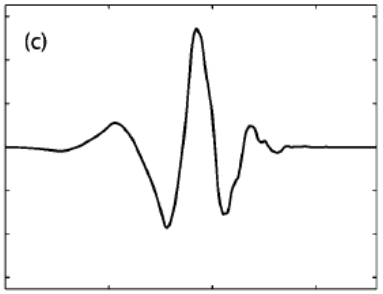




Baker (2007)

Near-fault ground motion index - Baker 2007

- Daubechies wavelet of order 4



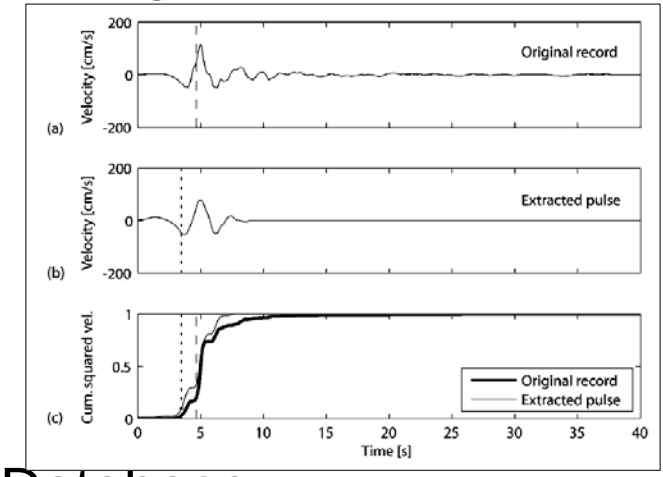
- Three criteria：
  - Pulse Indicator Value>0.85

$$Pulse\ indicator = \frac{1}{1 + e^{-23.3+14.6(PGV\ ratio)+20.5(energy\ ratio)}}$$

  - Early-Arriving Pulse

$$t_{20\%,orig} > t_{10\%,pulse}\ CSV(t) = \oint_0^t V^2(u)\,du$$

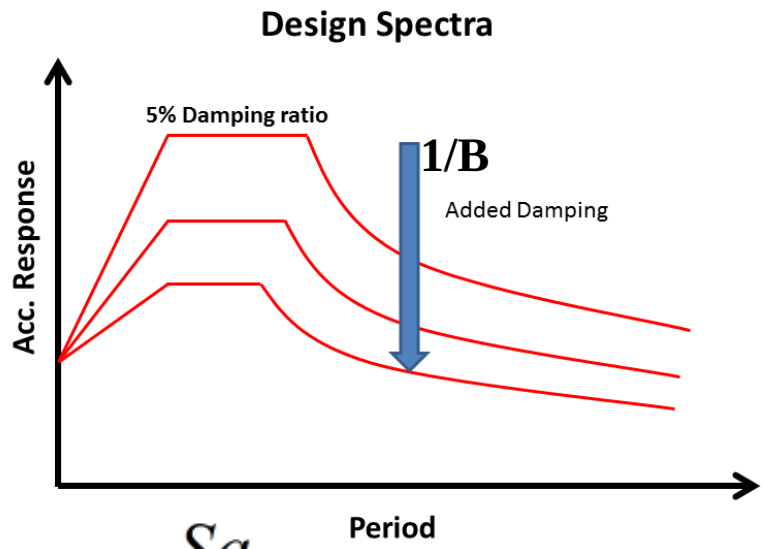
  - PGV>30 cm/sec



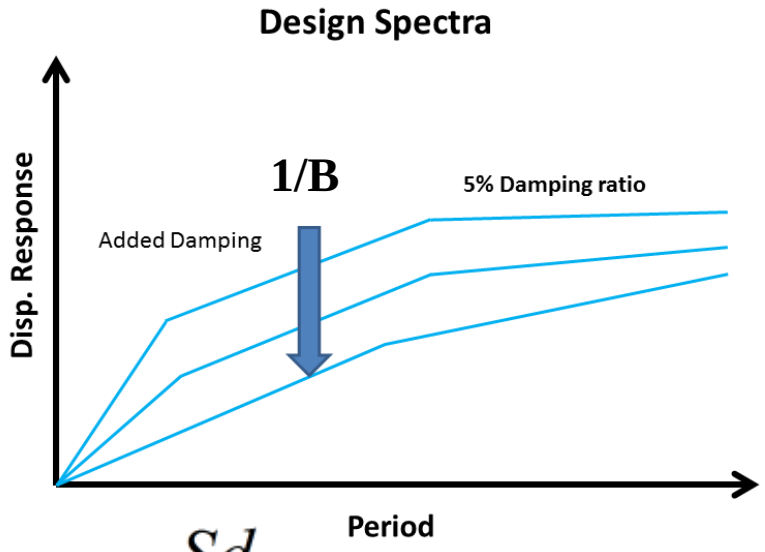
- 91 NF ground motions from NGA West 1 Database

Response Reduction Factors

- B-value
- Adjust the 5% spectra for other dampings



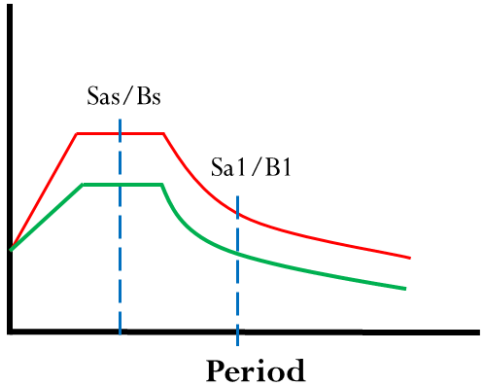
$$B_{Sa} = \frac{Sa_{5\%}}{Sa_{\xi}}$$



$$B_{Sd} = \frac{Sd_{5\%}}{Sd_{\xi}}$$

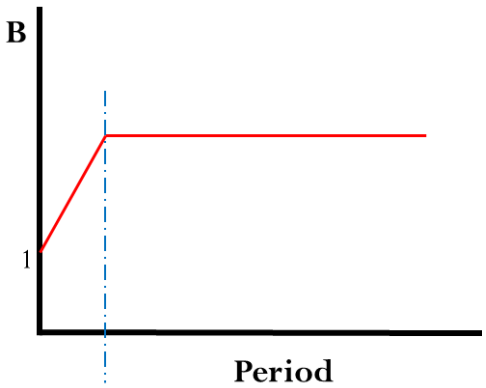
Building Code

- Taiwanese Code



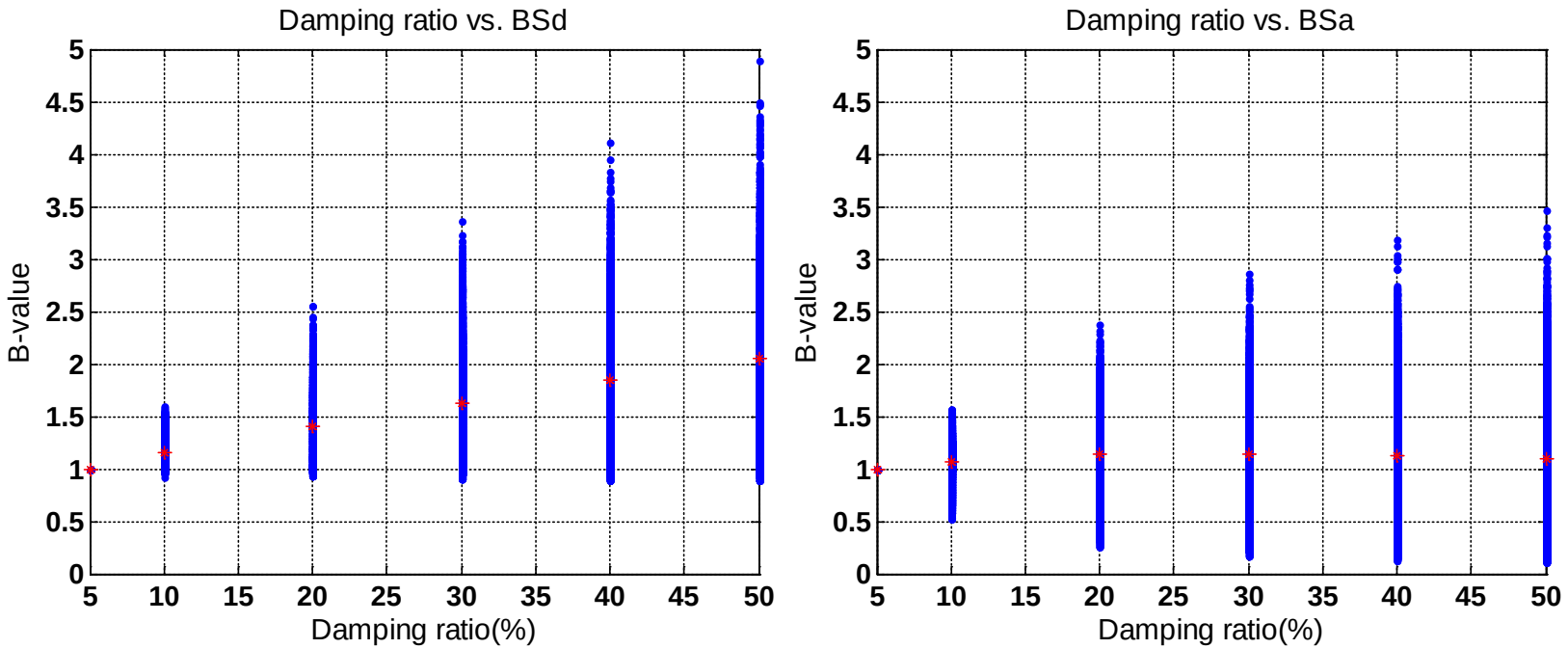
Effective damping ratio	Bs	B1
<2%	0.80	0.80
5%	1.00	1.00
10%	1.33	1.25
20%	1.60	1.50
30%	1.79	1.63
40%	1.87	1.70
>50%	1.93	1.75

- ASCE7-10



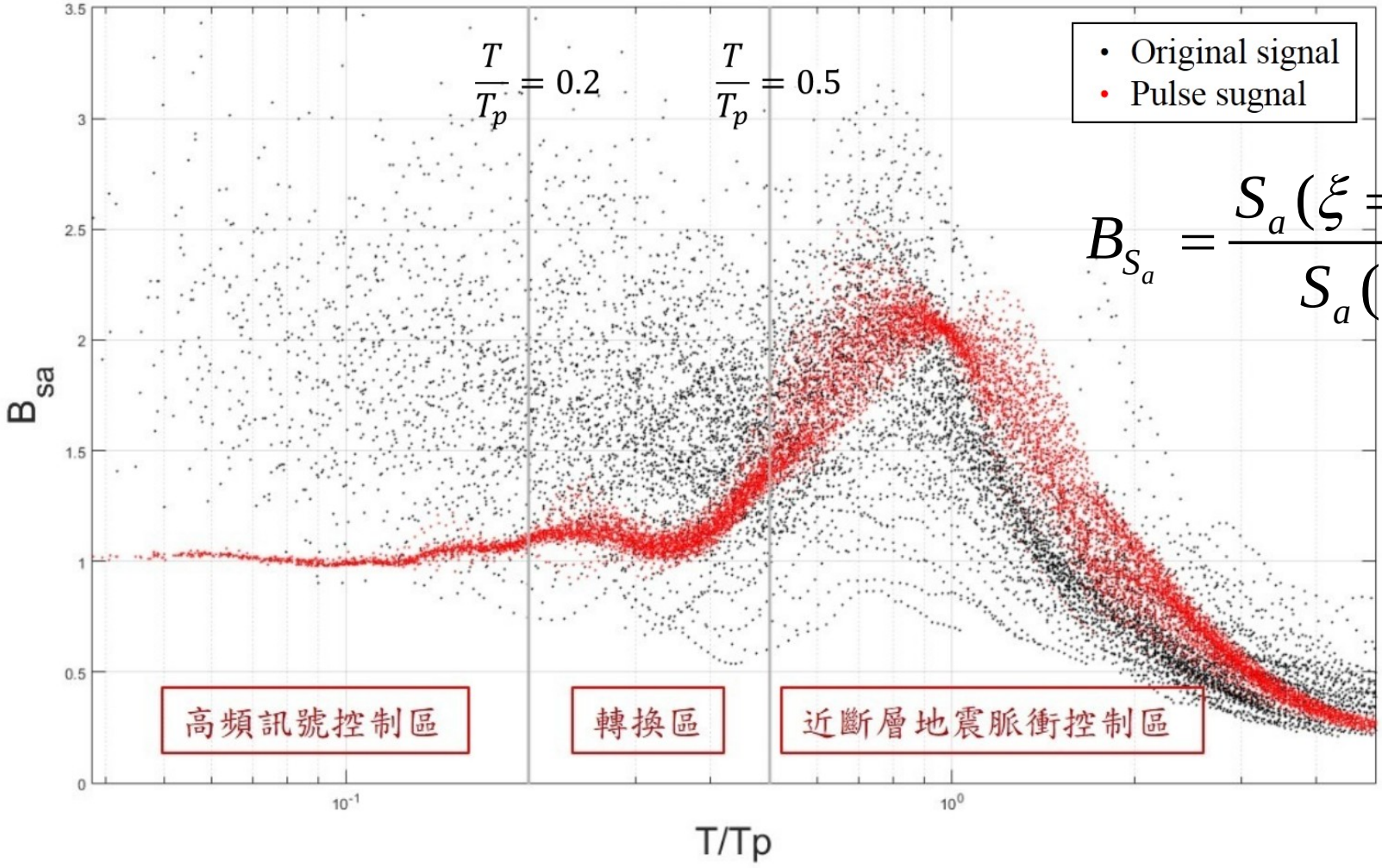
Effective damping ratio	B	Effective damping ratio	B
2%	0.8	50%	2.4
5%	1	60%	2.7
10%	1.2	70%	3
20%	1.5	80%	3.3
30%	1.8	90%	3.6
40%	2.1	100%	4

Variability in B-value



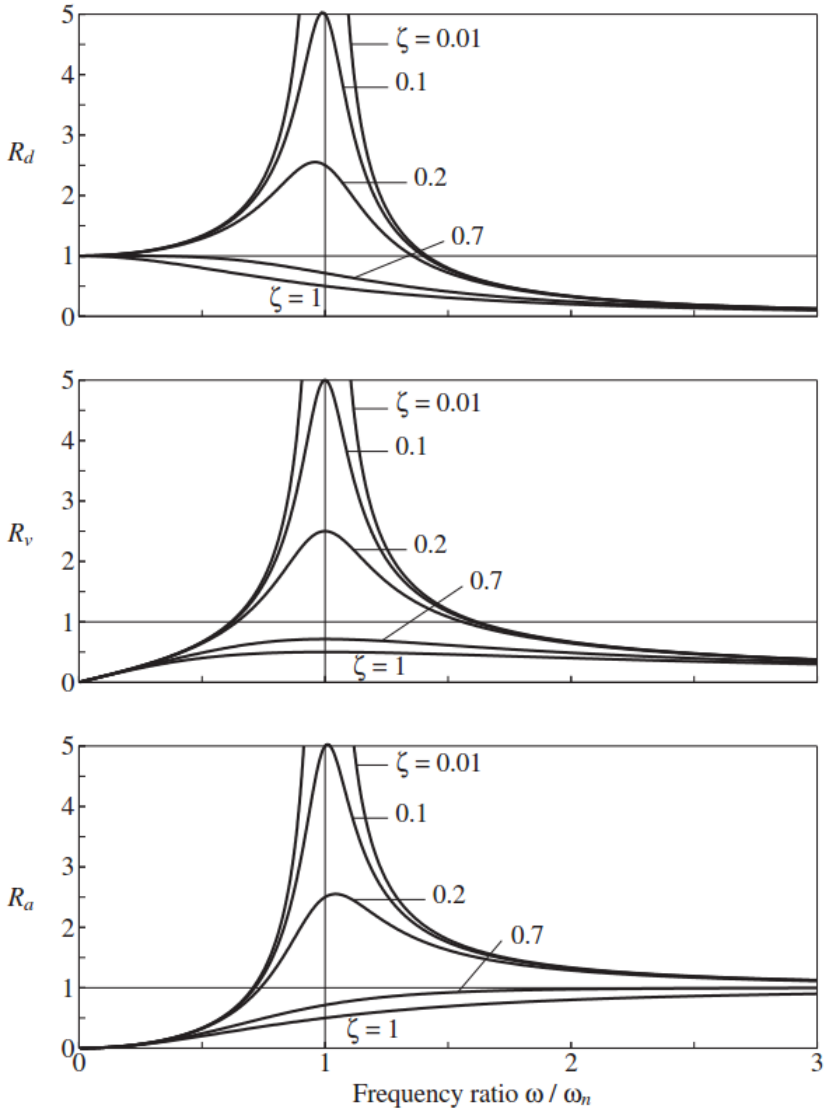
Period from 0 to 10sec and Interval is 0.2 sec

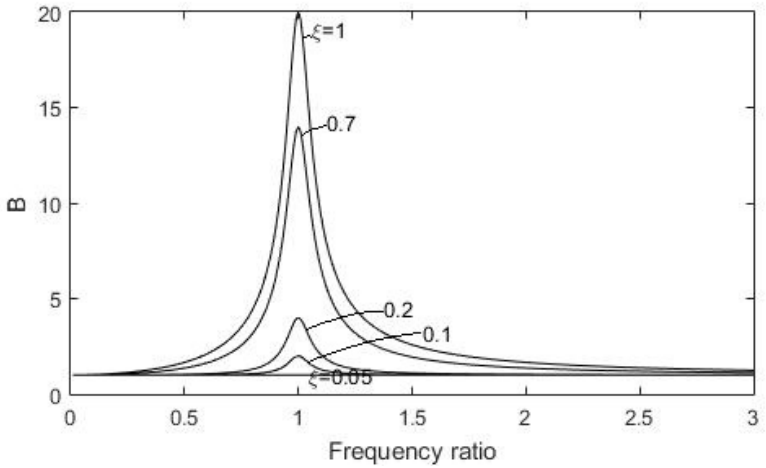
Impact of pulse on response reduction factor



Residual-Control Zone **Transition Zone** **Pulse-Control Zone**

Dynamic response factors





$$B = \frac{R_{5\%}}{R_\xi}$$

Thank you

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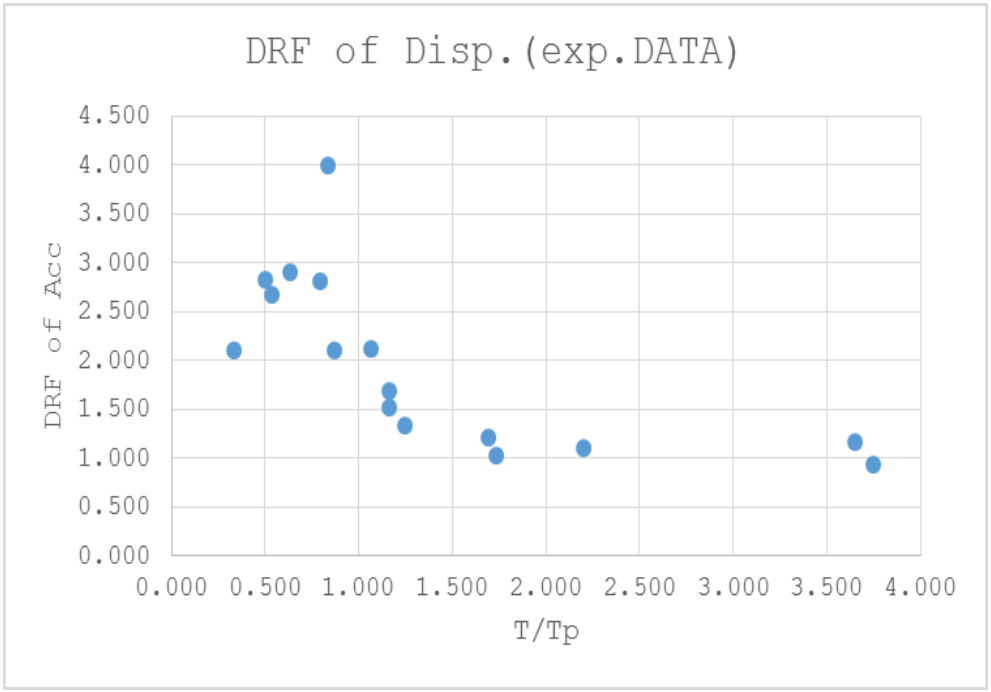
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DRF of Acc
T/Tp
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4.000
3.500
3.000
2.500
2.000
1.500
1.000
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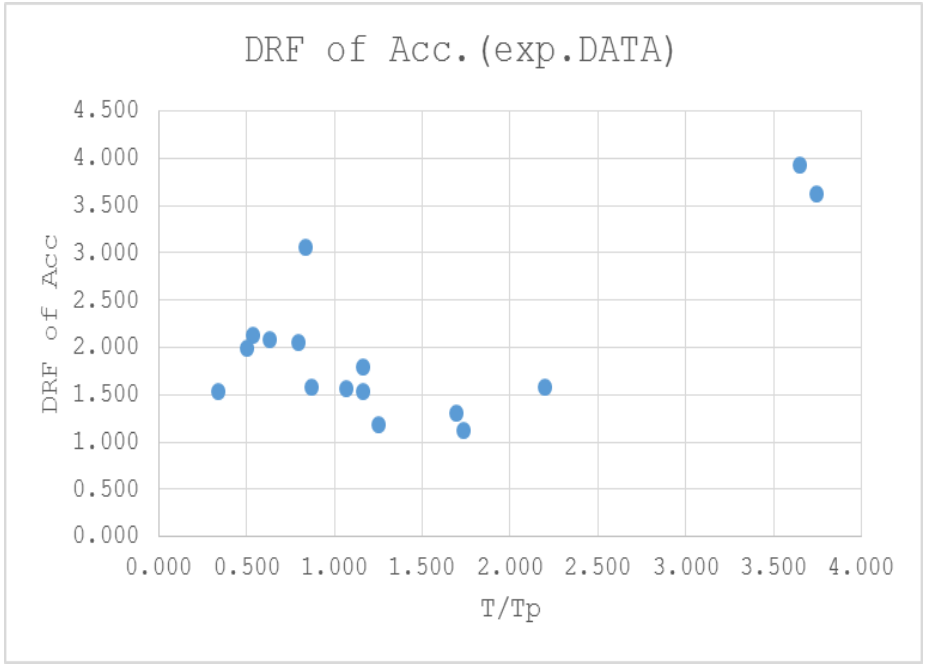
DRF of Acc.(exp.DATA)
DRF of Acc
T/Tp
4.500
4.000
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