Damper Coefficient for a Target Damping Ratio

Critical damping of a corner, the wheel and damper coefficients for a target damping ratio, the damper force at a shaft speed and the damped natural frequency.

Method: Single-degree-of-freedom damping

Input parameters

Unit system: SI

Parameter	Value	Unit
Sprung mass at the corner	350.00	kg
Ride rate at the wheel	25.000	N/mm
Target damping ratio	30.000	%
Damper motion ratio	0.80000	
Damper shaft speed	0.10000	m/s

Calculated results

Parameter	Value	Unit
Critical damping at the wheel	5,916.1	
Wheel damping coefficient (N·s/m)	1,774.8	
Damper coefficient (N·s/m)	2,773.2	
Damper force at that speed	277.32	N
Damped natural frequency	1.2831	Hz

Notes for this case

• c_c = 2√(k_rm_c); c_w = ζc_c; damper coefficient c_d = c_w/MR_d² (motion ratio squared, as for springs). Comfort-oriented cars use ζ ≈ 0.2–0.3, sporty 0.3–0.5, race cars 0.6–0.8 in low-speed damping; real dampers are non-linear and use different bump and rebound values.

Formula and method

$$c_c = 2\sqrt{k_r m_c}, \quad c_d = \frac{\zeta c_c}{MR_d^2}, \quad f_d = \frac{\sqrt{k_r/m_c}\sqrt{1-\zeta^2}}{2\pi}$$

Variables

m_c	Sprung mass at the corner	kg
k_r	Ride rate at the wheel	N/m
ζ	Target damping ratio	-
MR_d	Damper motion ratio	-
v_d	Damper shaft speed	m/s
c_c	Critical damping at the wheel	-
c_w	Wheel damping coefficient (N·s/m)	-
c_d	Damper coefficient (N·s/m)	-
F_d	Damper force at that speed	N
f_d	Damped natural frequency	1/s

Method and standards

Damping.

Assumptions and limits

- Linear damper; single mass on a spring.

References

Single-degree-of-freedom damping

Report details

Report reference	FCC-HEPA-P3CY (the same inputs always give the same reference)
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/automotive/vehicle-dynamics/damper-damping-ratio

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.