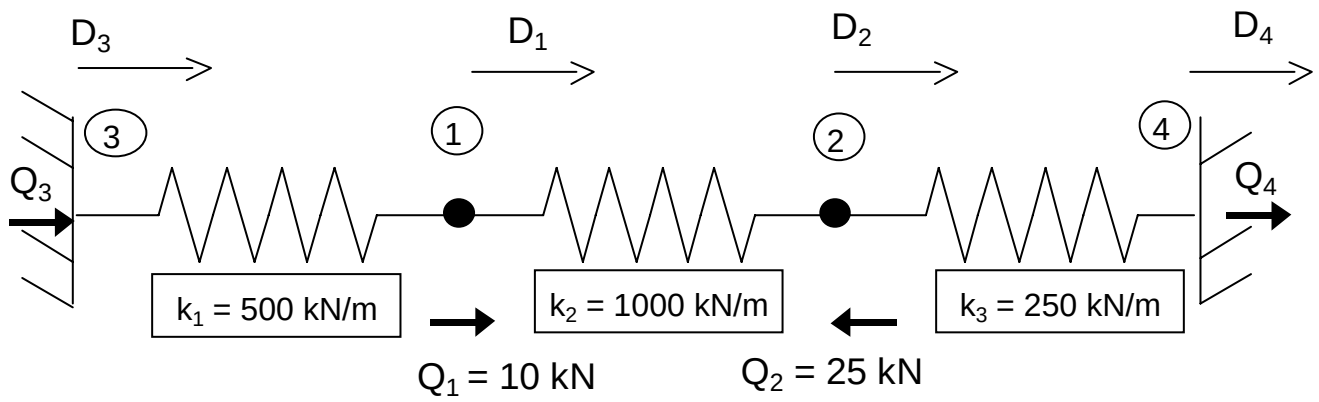
CEE 379 **2 DOF Spring Example**



Spring Force-Deformation Relationships

	{q}	=	[k']		*	{d}	
			3	1			
Spring 1							
k_1 = 500	q_N	=	500	-500	*	d_N	3
kN/m	q_F		-500	500		d_F	1
			1	2			
Spring 2							
k_2 = 1000	q_N	=	1000	-1000	*	d_N	1
kN/m	q_F		-1000	1000		d_F	2
			2	4			
Spring 3							
k_3 = 250	q_N	=	250	-250	*	d_N	2
kN/m	q_F		-250	250		d_F	4

Compatibility

Boundary Conditions:	$d_{N1} = D_3 = 0$	Nodal Connectivity:	$d_{F1} = d_{N2} = D_1$
	$d_{F3} = D_4 = 0$		$d_{F2} = d_{N3} = D_2$

System Stiffness Equations

[K]					*	{D}	=	{Q}
1	2	3	4					
1500	-1000	-500	0	1	*	D_1	=	Q_1
-1000	1250	0	-250	2		D_2		Q_2
-500	0	500	0	3		D_3		Q_3
0	-250	0	250	4		D_4		Q_4

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Solve for Nodal Displacements

$[K_{11}] * \{D_u\} = \{Q_k\}$

	1	2					
	1500	-1000	1	*	D_1	=	Q_1
	-1000	1250	2		D_2		Q_2

$[K_{11}^{-1}] * \{Q_k\} = \{D_u\}$

0.0014	0.0011	*	10	=	-0.014	m
0.0011	0.0017		-25		-0.031	m

Spring End Forces (positive to right, negative to left)

$[k'] * \{d\} = \{q\}$

Spring 1	500	-500	*	0.000	=	7.14	kN
	-500	500		-0.014		-7.14	kN
Spring 2	1000	-1000	*	-0.014	=	17.14	kN
	-1000	1000		-0.031		-17.14	kN
Spring 3	250	-250	*	-0.031	=	-7.86	kN
	-250	250		0.000		7.86	kN

Spring Internal Forces (tension positive, compression negative)

Spring 1 $T_1 =$ -7.14 kN

Spring 2 $T_2 =$ -17.14 kN

Spring 3 $T_3 =$ 7.86 kN