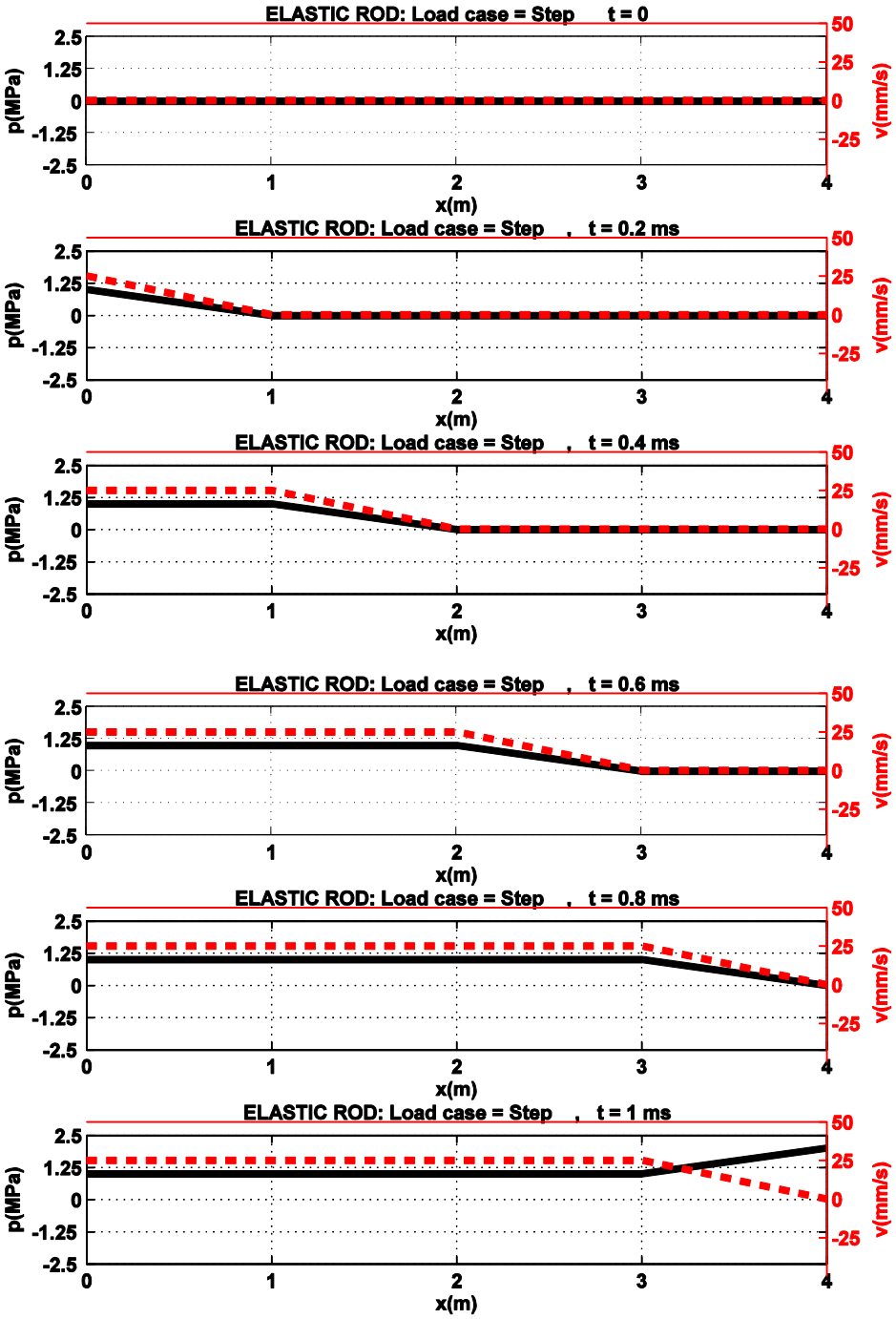
ROD EXAMPLE

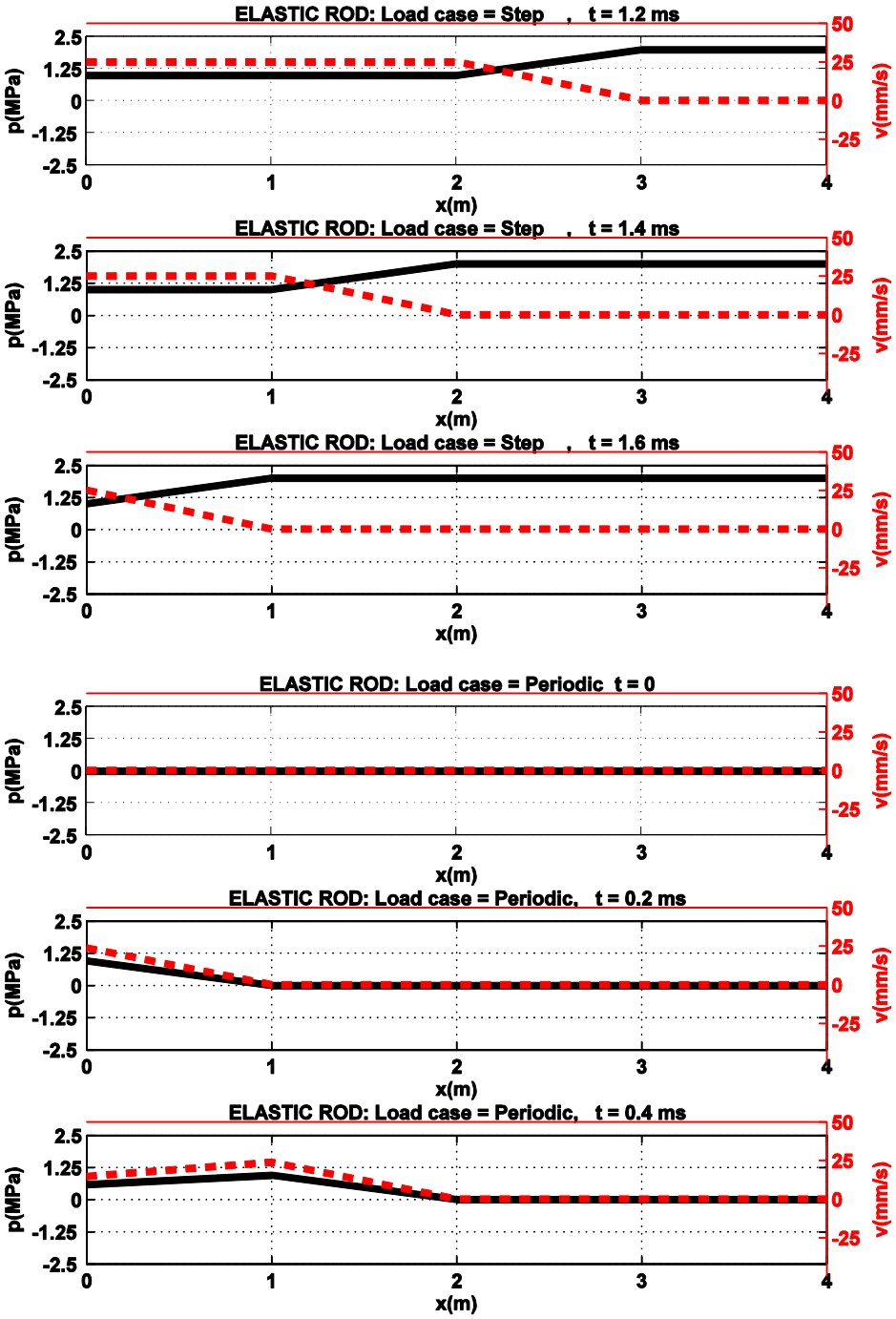
A 4 m long rod is connected to a fixed support at one end and to a load cell at the other end. The cross-sectional area of the rod is 10^{-3} m^2. The material properties are E = 200GPa, ρ = 8000 kg/m3.

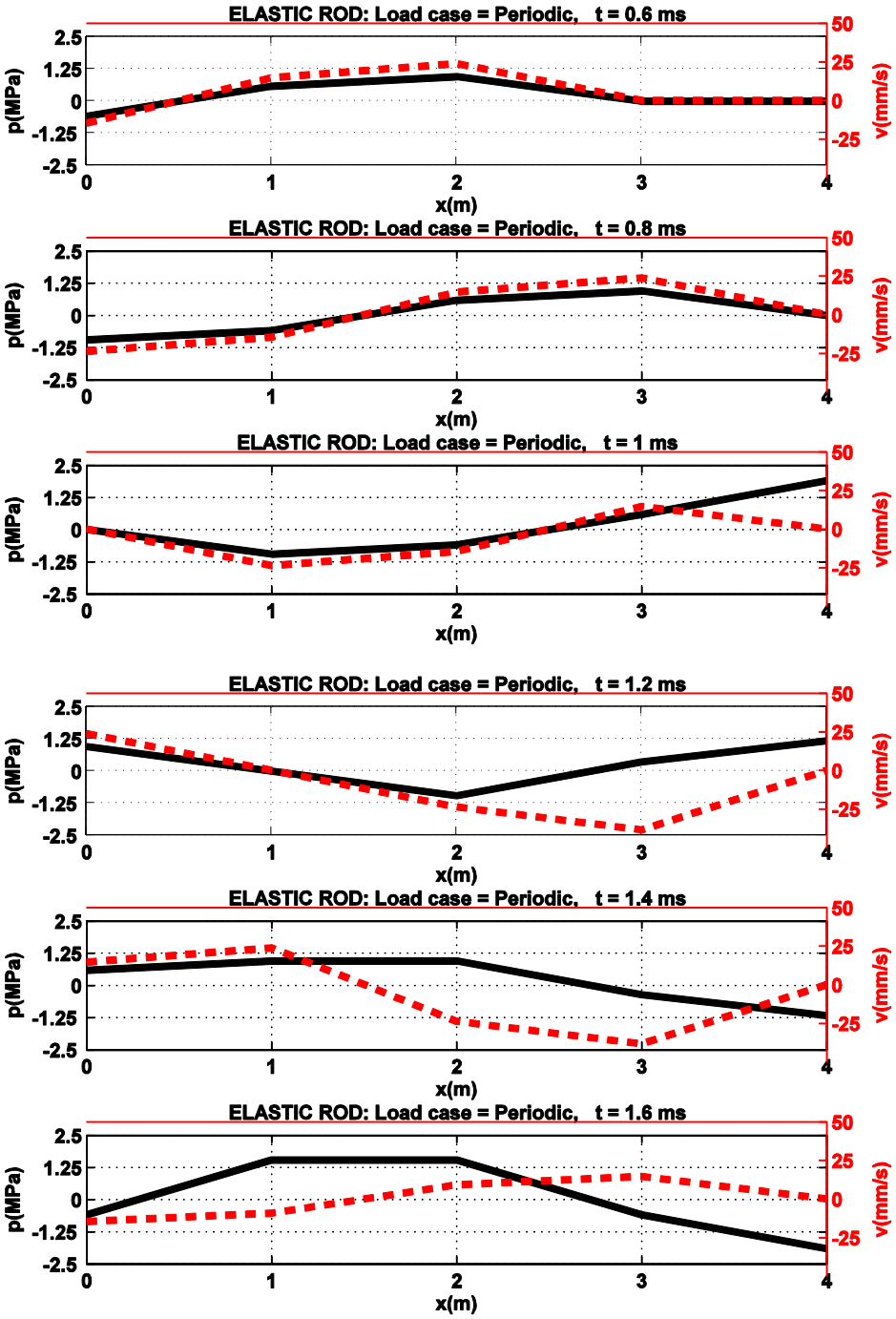
Initially the rod particles are not moving and the normal stress is zero. The fixed support imposes zero displacement.

Calculate the normal stress and the speed of particles resulting from loading the rod for two load cases:

- *Compressive force Fo* = 1 kN *applied in 0.2ms and then maintained constant*
- *Periodic load with amplitude Fo* = 1 kN *and frequency f = 1kHz.*


ELASTIC ROD: Load case = Step t = 0
ELASTIC ROD: Load case = Step , t = 0.2 ms
ELASTIC ROD: Load case = Step , t = 0.4 ms
ELASTIC ROD: Load case = Step , t = 0.6 ms
ELASTIC ROD: Load case = Step , t = 0.8 ms
ELASTIC ROD: Load case = Step , t = 1 ms
p(MPa)
v(mm/s)
x(m)
2.5
1.25
0
-1.25
-2.5
50
25
0
-25
1
2
3
4


ELASTIC ROD: Load case = Step , t = 1.2 ms
ELASTIC ROD: Load case = Step , t = 1.4 ms
ELASTIC ROD: Load case = Step , t = 1.6 ms
ELASTIC ROD: Load case = Periodic t = 0
ELASTIC ROD: Load case = Periodic, t = 0.2 ms
ELASTIC ROD: Load case = Periodic, t = 0.4 ms
p(MPa)
v(mm/s)
x(m)
2.5
1.25
0
-1.25
-2.5
50
25
0
-25
0
1
2
3
4


ELASTIC ROD: Load case = Periodic, t = 0.6 ms
ELASTIC ROD: Load case = Periodic, t = 0.8 ms
ELASTIC ROD: Load case = Periodic, t = 1 ms
ELASTIC ROD: Load case = Periodic, t = 1.2 ms
ELASTIC ROD: Load case = Periodic, t = 1.4 ms
ELASTIC ROD: Load case = Periodic, t = 1.6 ms
p(MPa)
v(mm/s)
x(m)
2.5
1.25
0
-1.25
-2.5
50
25
0
-25
1
2
3
4