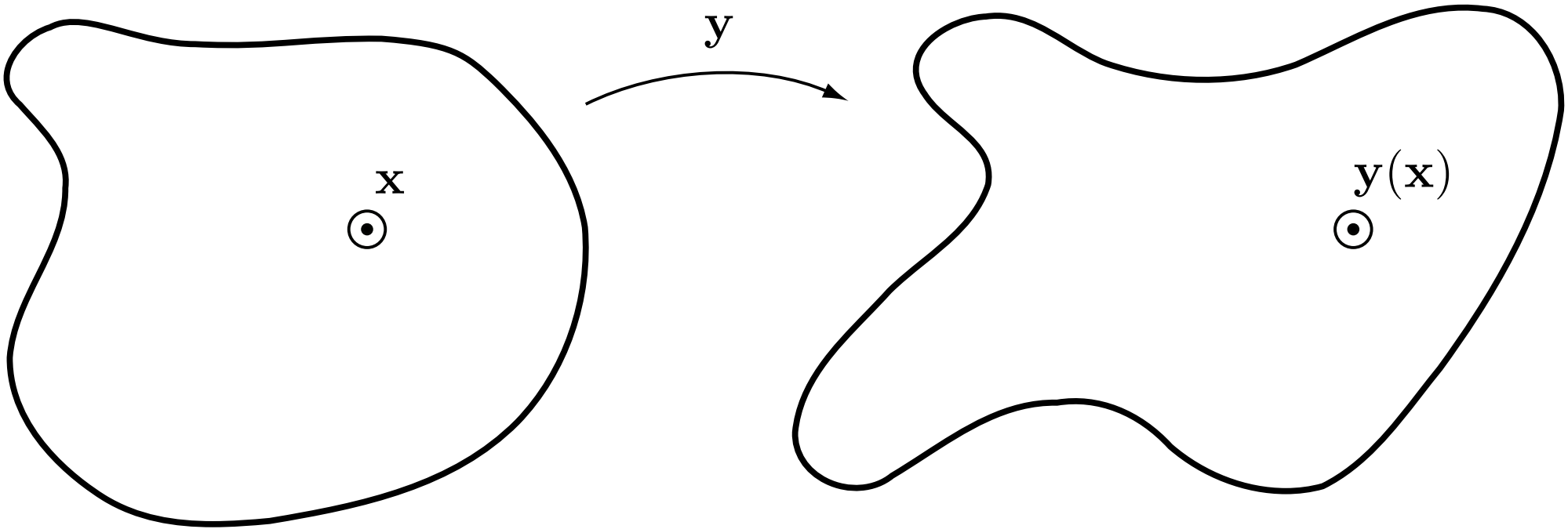
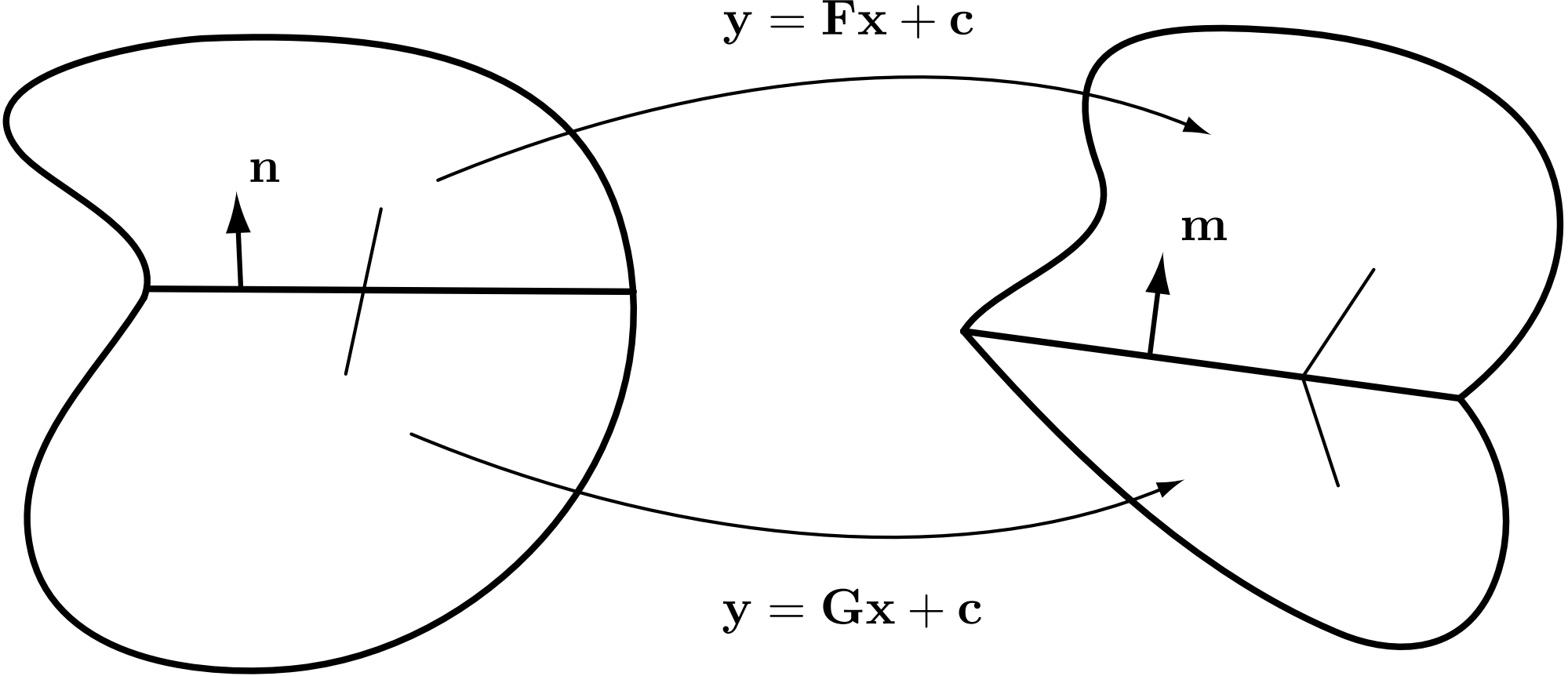
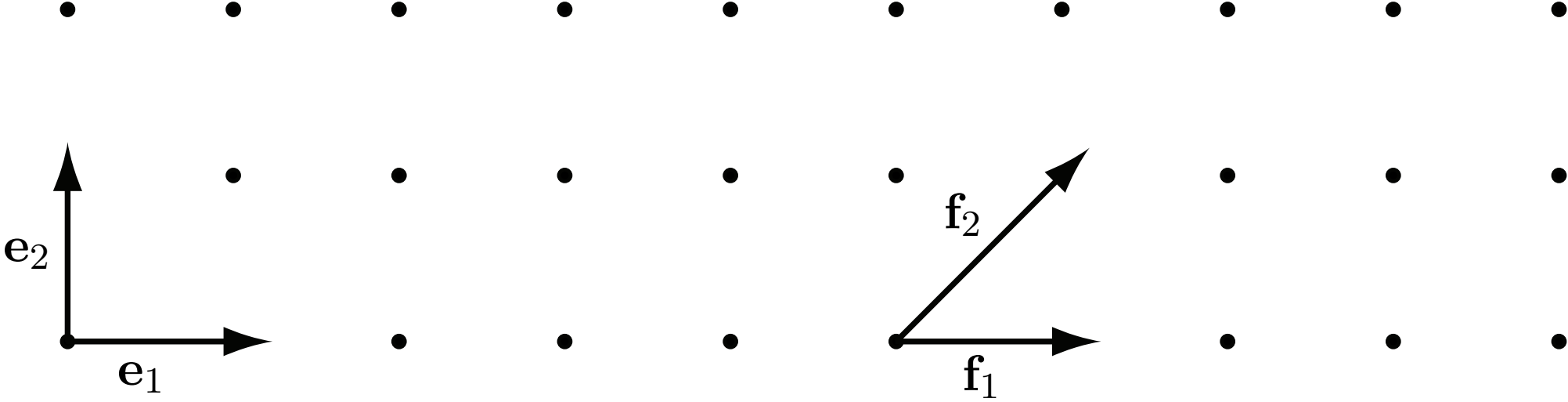
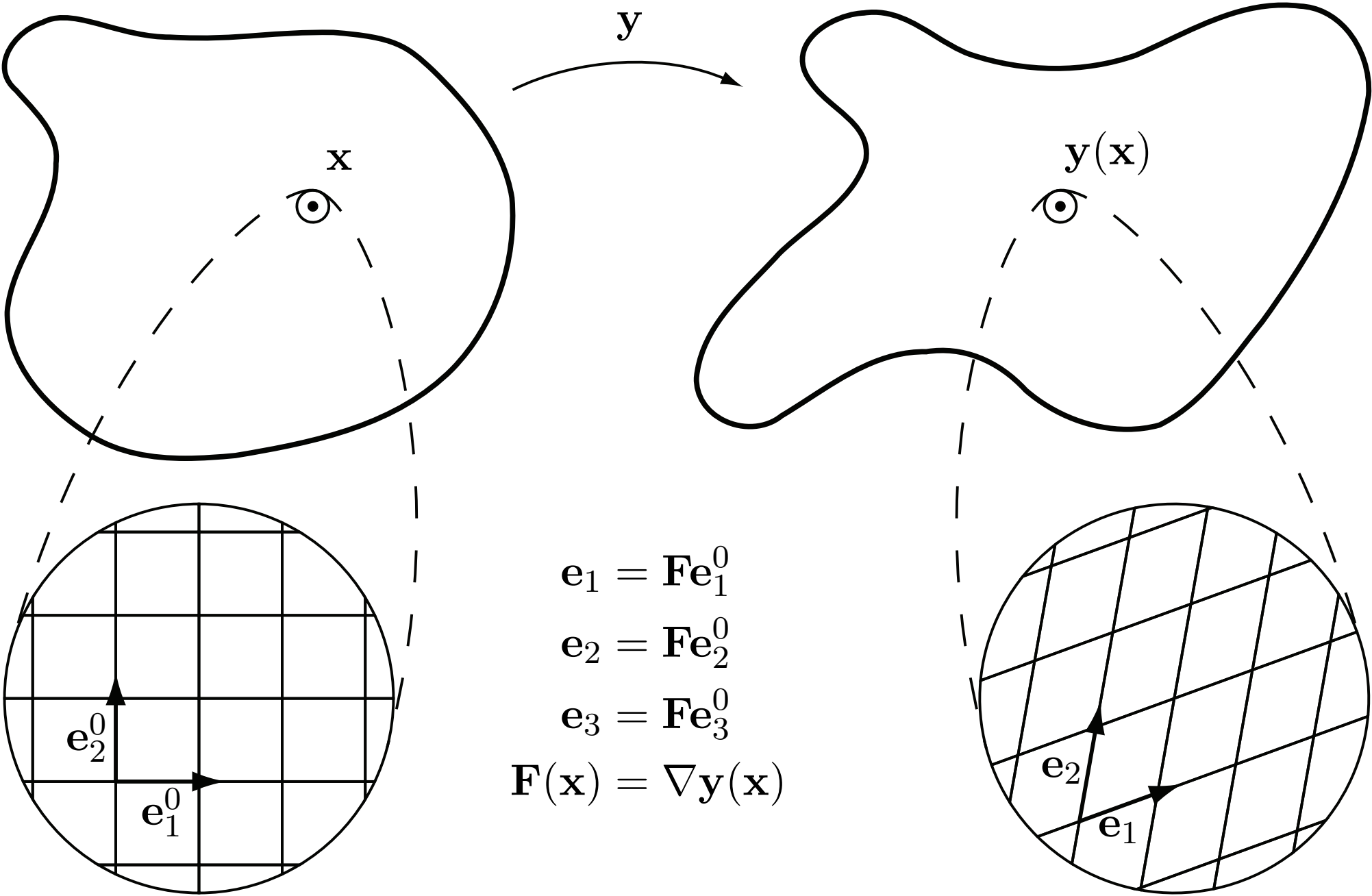
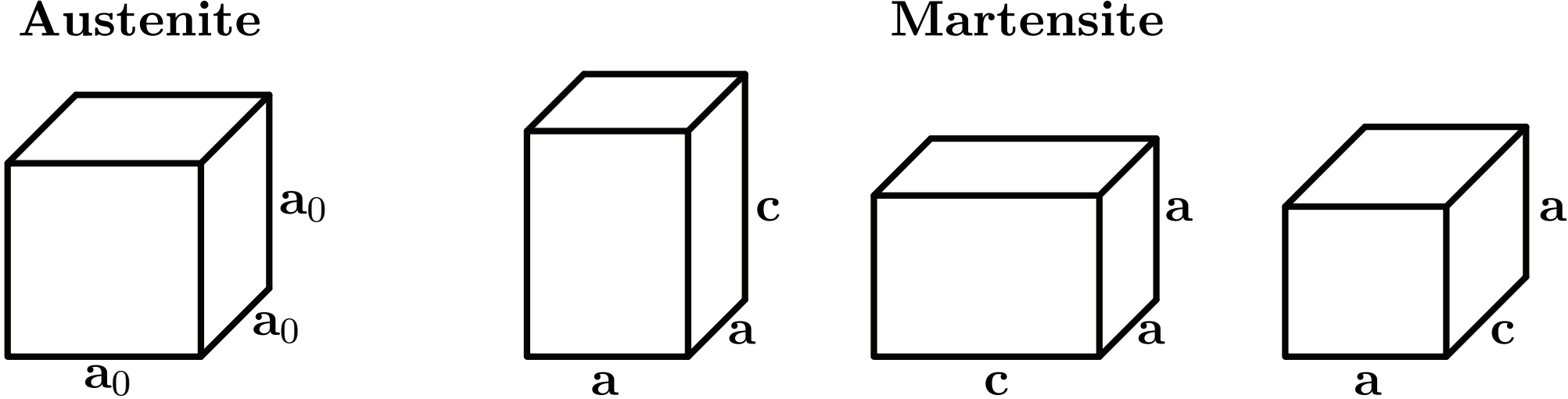

y
x
y(x)

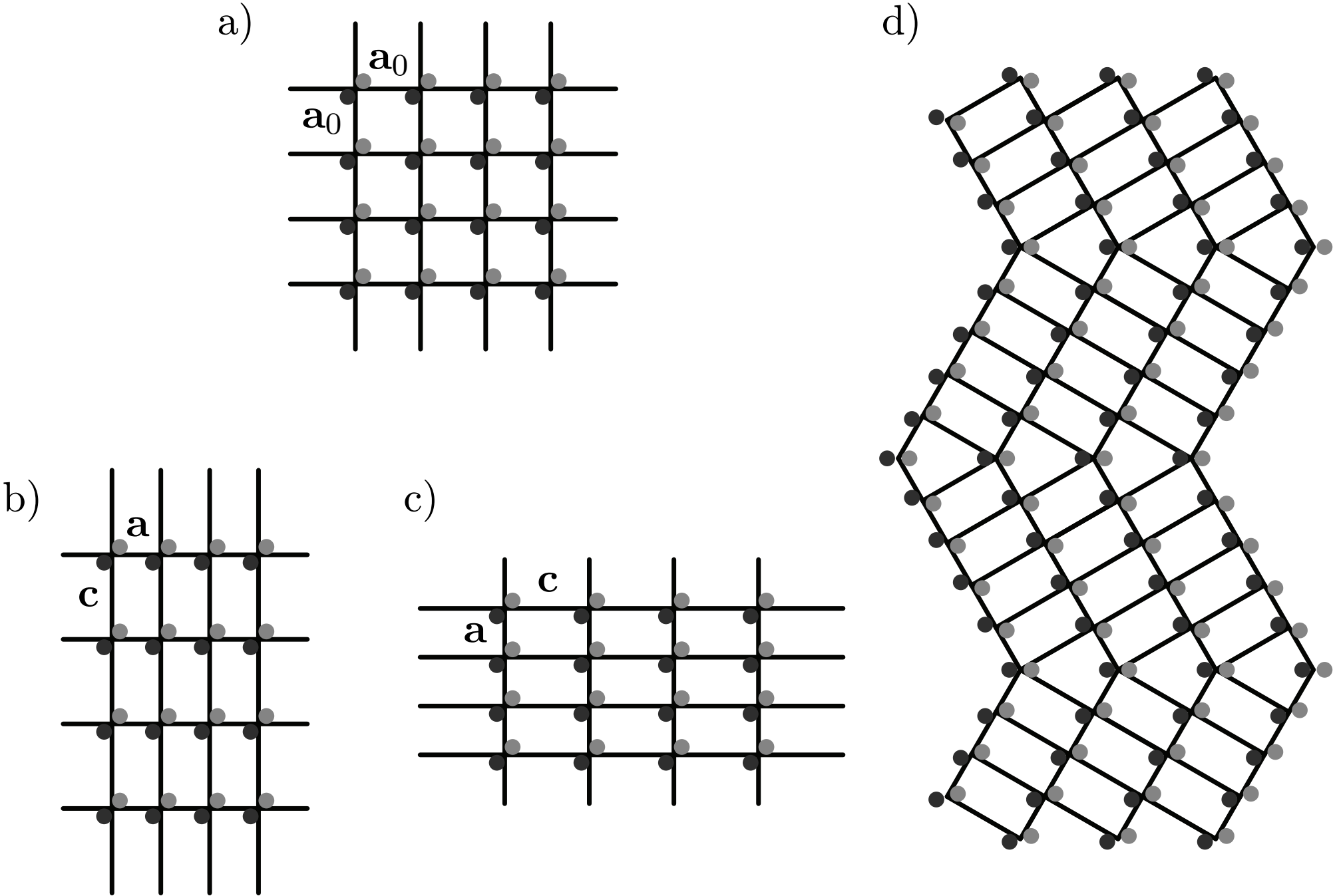

$\mathbf{y} = \mathbf{F}\mathbf{x} + \mathbf{c}$
$\mathbf{n}$
$\mathbf{m}$
$\mathbf{y} = \mathbf{G}\mathbf{x} + \mathbf{c}$

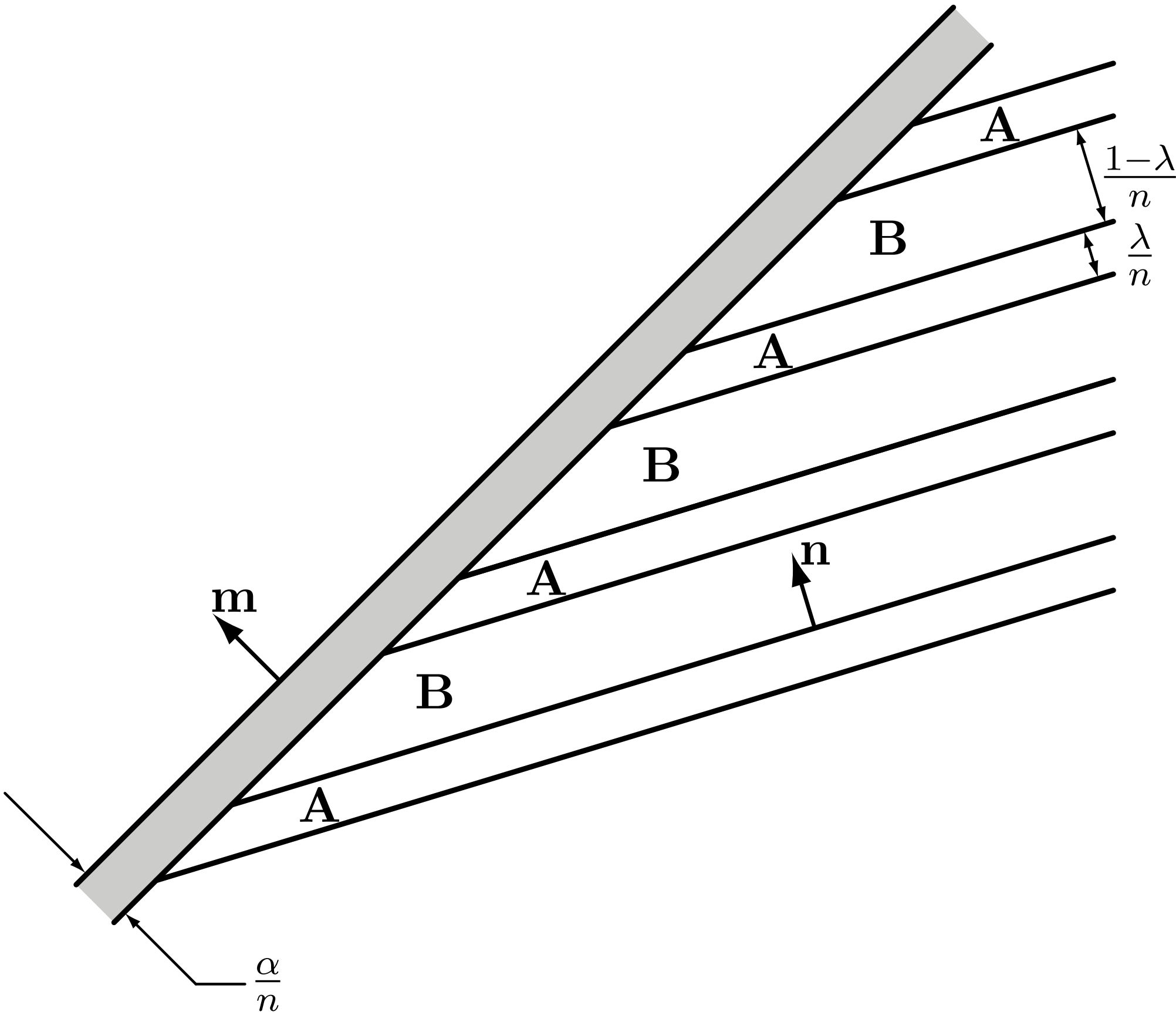

$\mathbf{e}_2$
$\mathbf{e}_1$
$\mathbf{f}_2$
$\mathbf{f}_1$

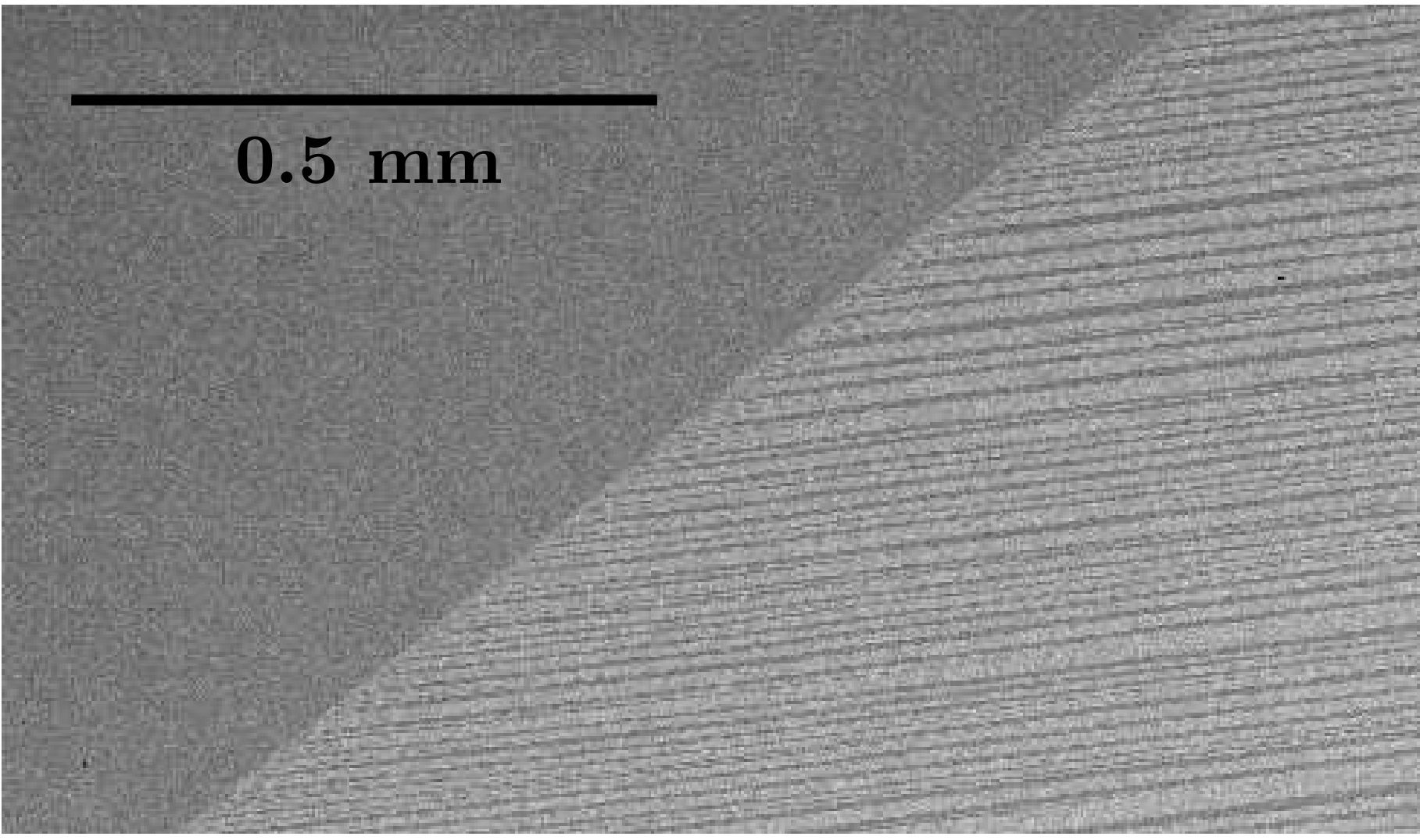


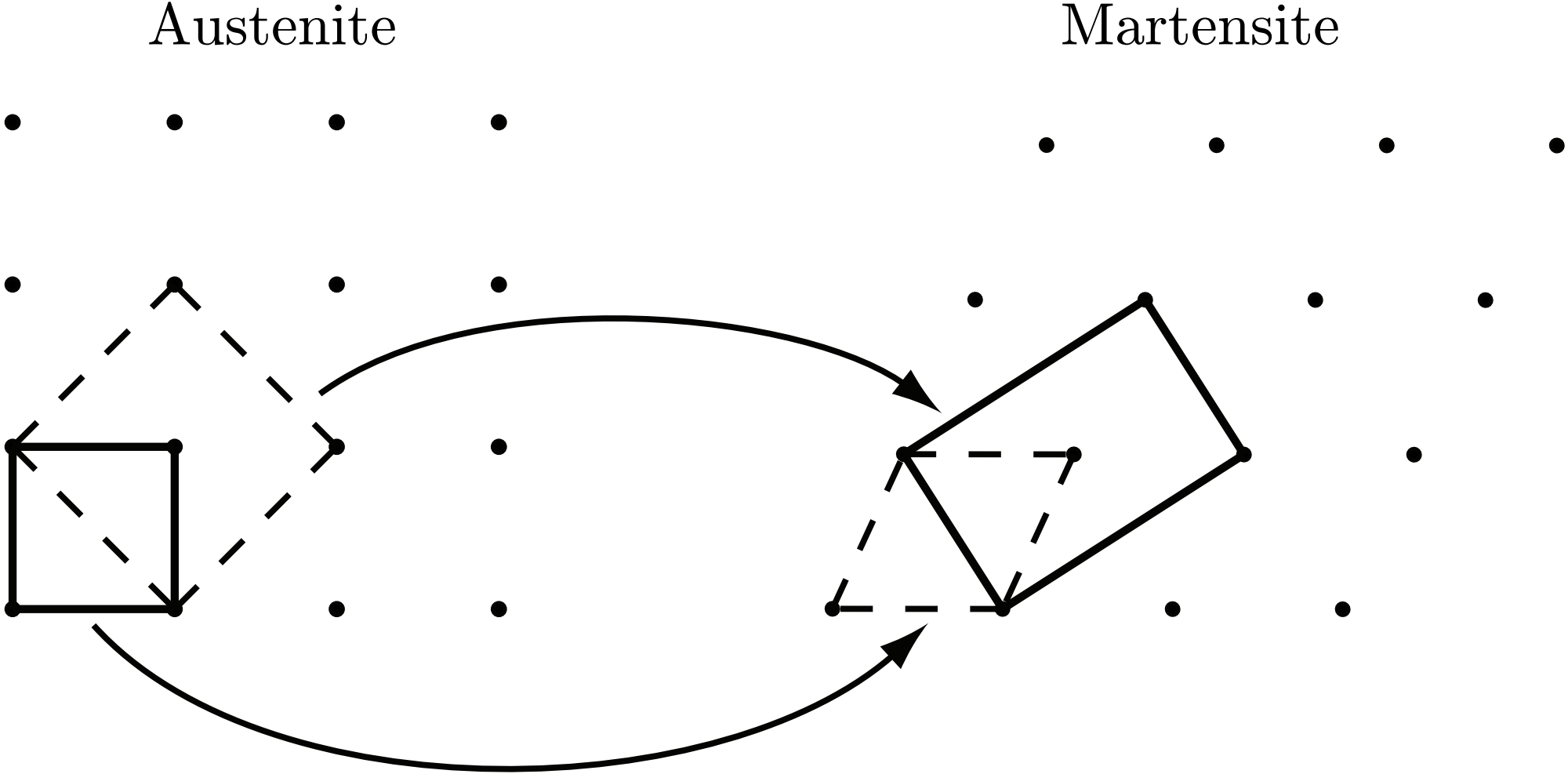

$$\mathbf{e}_1 = \mathbf{F}\mathbf{e}_1^0$$
$$\mathbf{e}_2 = \mathbf{F}\mathbf{e}_2^0$$
$$\mathbf{e}_3 = \mathbf{F}\mathbf{e}_3^0$$
$$\mathbf{F}(\mathbf{x}) = \nabla \mathbf{y}(\mathbf{x})$$

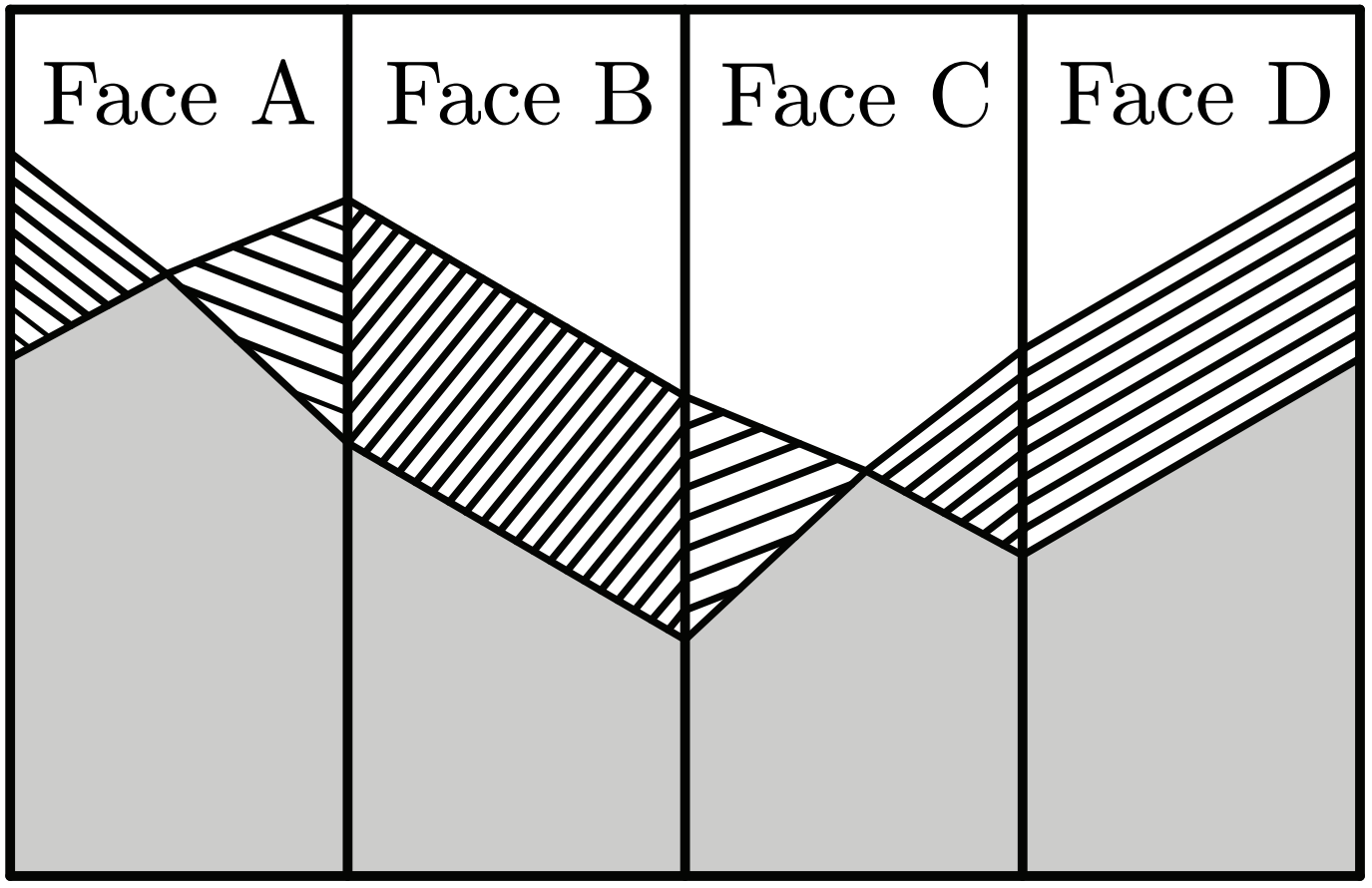

Austenite
Martensite
a0
a0
a0
c
a
a
a
a
c
a
c
a


a)
$\mathbf{a}_0$
$\mathbf{a}_0$
b)
$\mathbf{a}$
$\mathbf{c}$
c)
$\mathbf{c}$
$\mathbf{a}$
d)

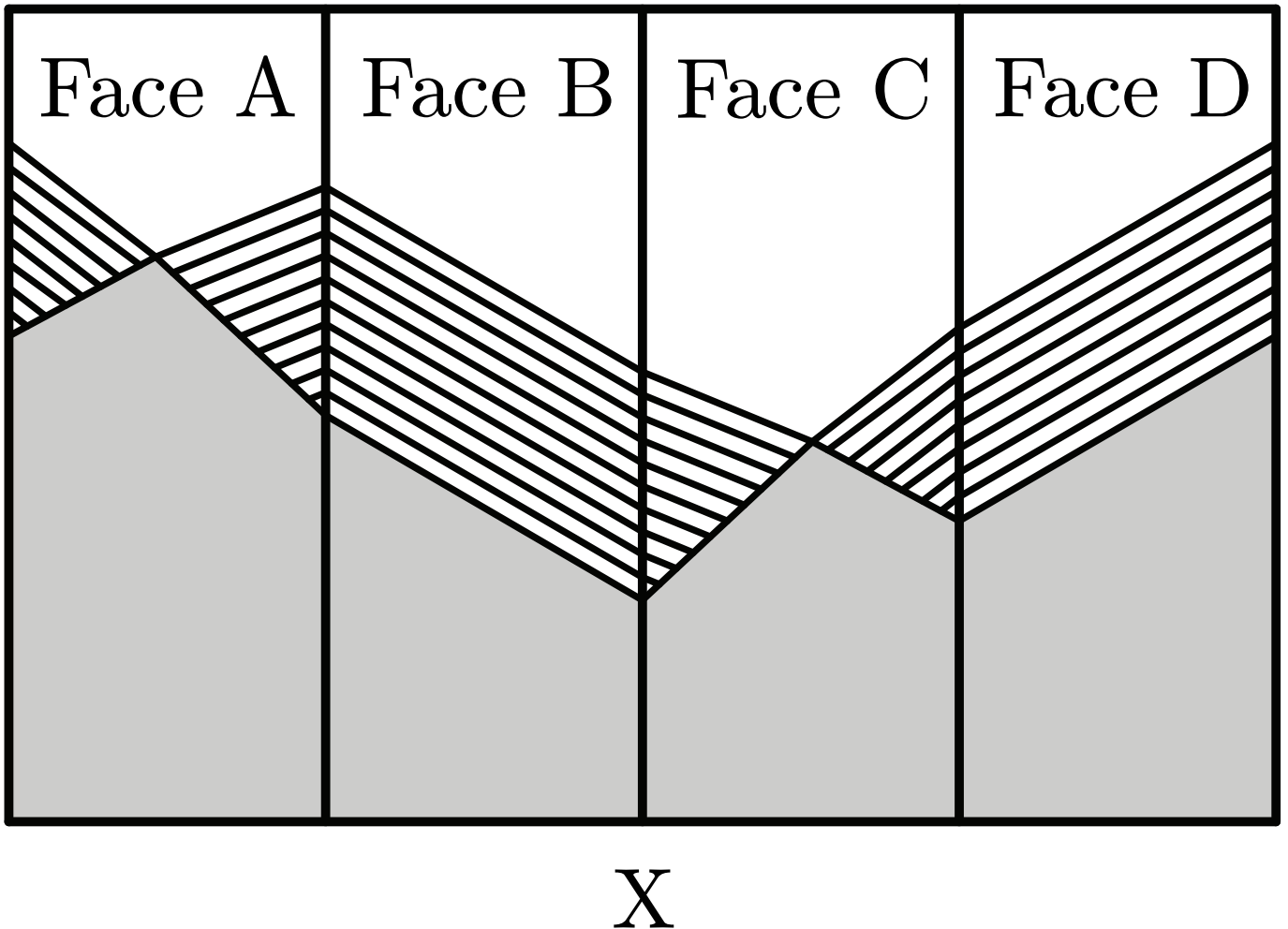

A
B
A
B
A
B
A
$\frac{1-\lambda}{n}$
$\frac{\lambda}{n}$
n
m
$\frac{\alpha}{n}$

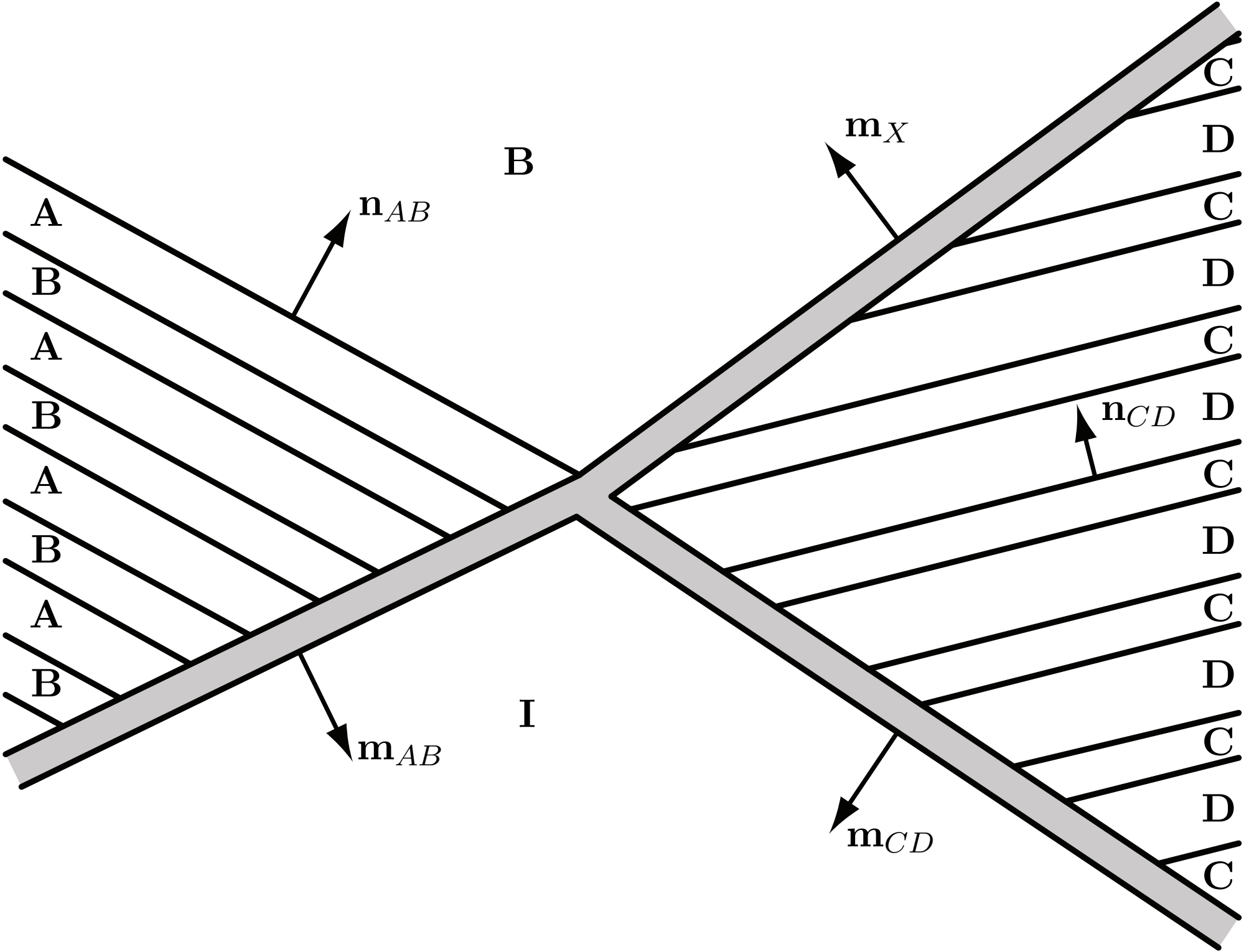

0.5 mm

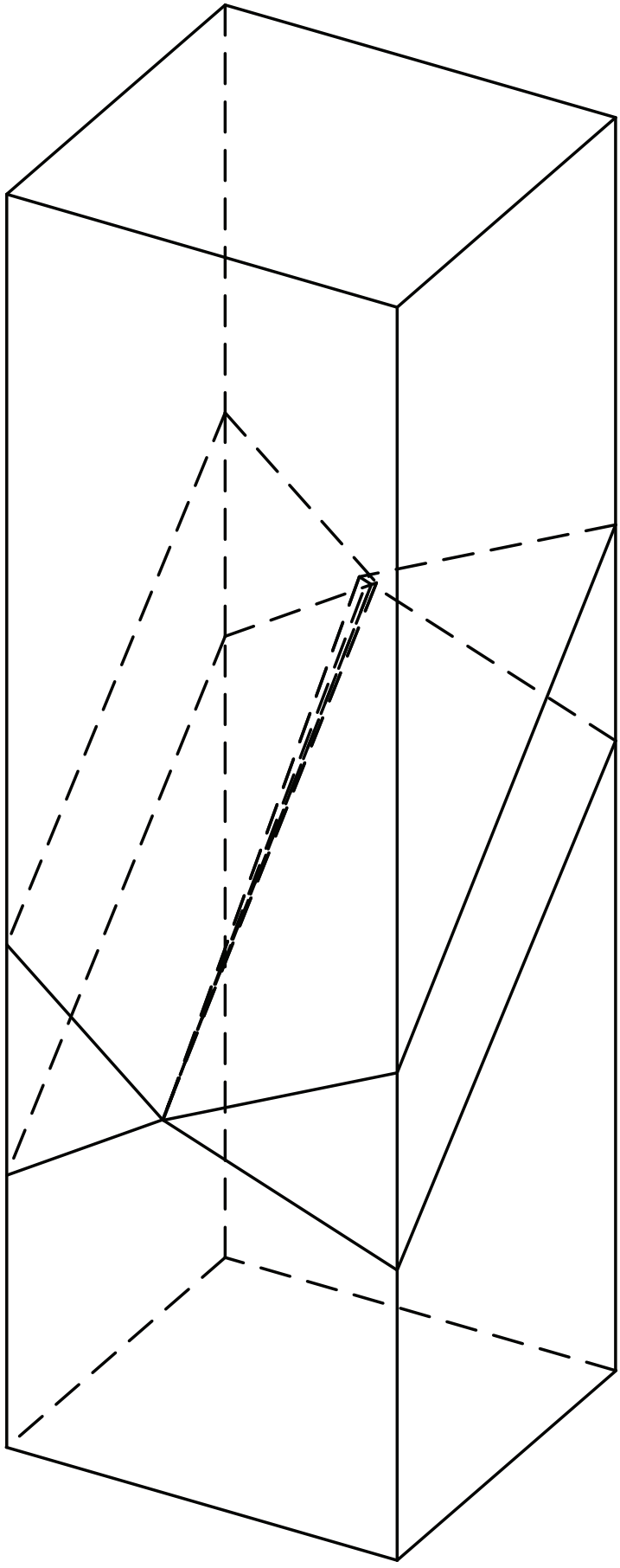

Austenite
Martensite



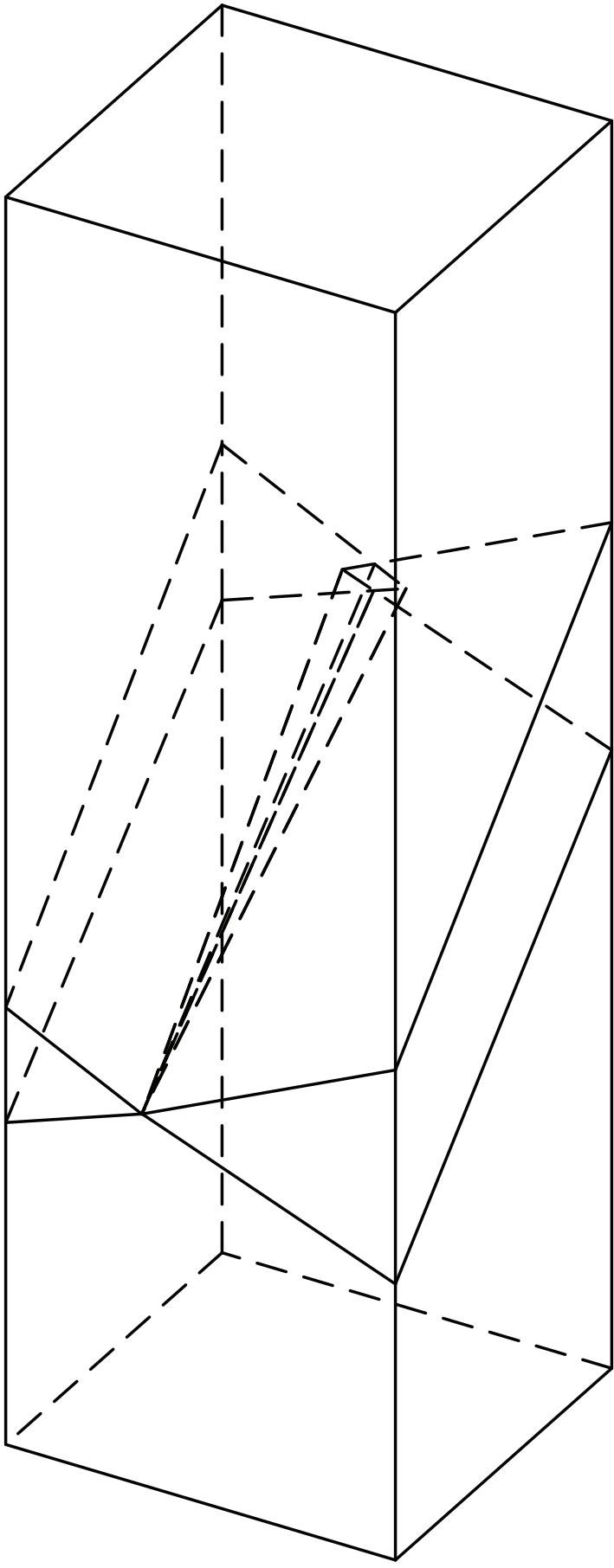

Lambda


Face A
Face B
Face C
Face D
X

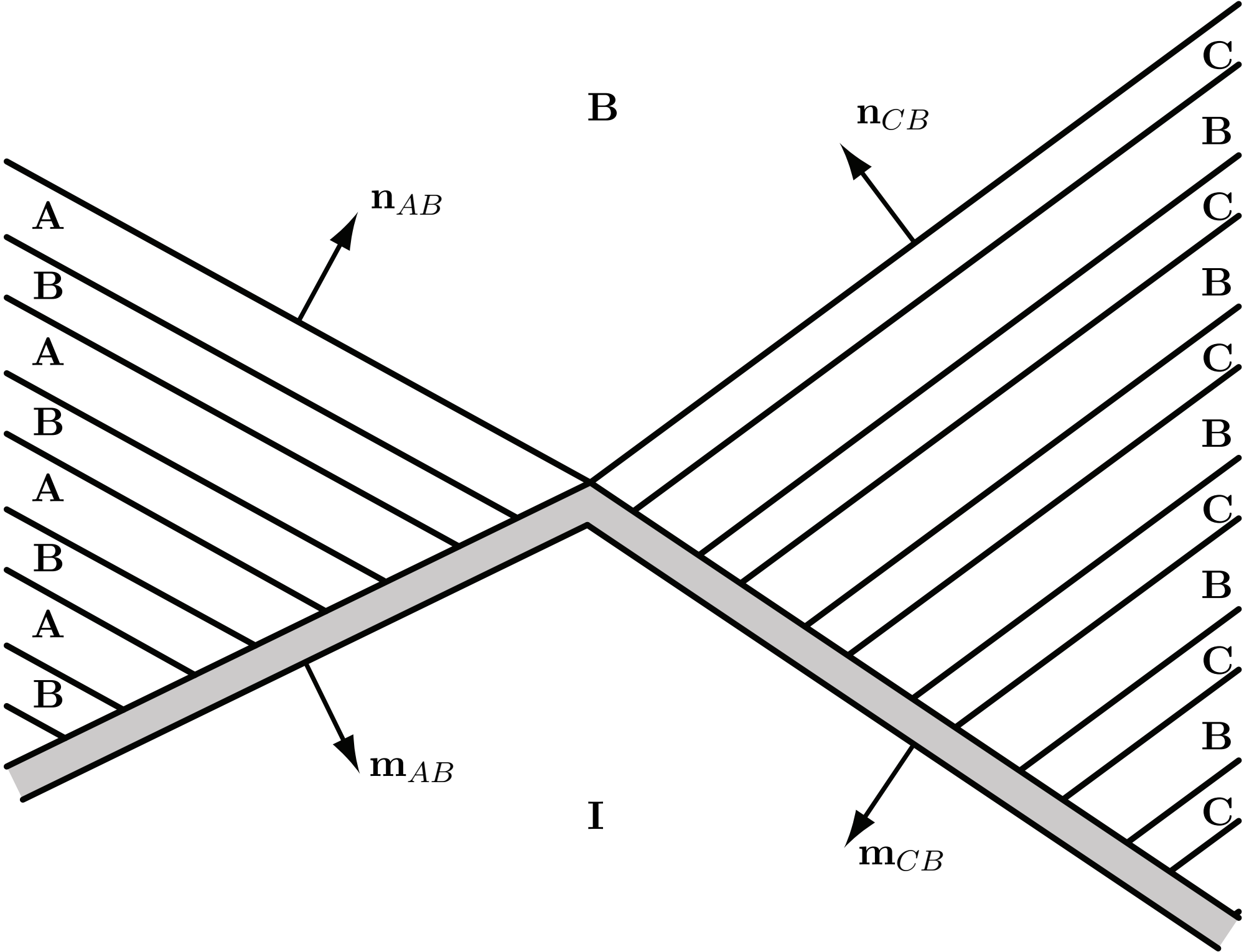

A
B
A
B
A
B
A
B
B
$\mathbf{n}_{AB}$
$\mathbf{m}_{AB}$
$\mathbf{m}_X$
$\mathbf{n}_{CD}$
$\mathbf{m}_{CD}$
C
D
C
D
C
D
C
D
C
D
C
D
C
B
I

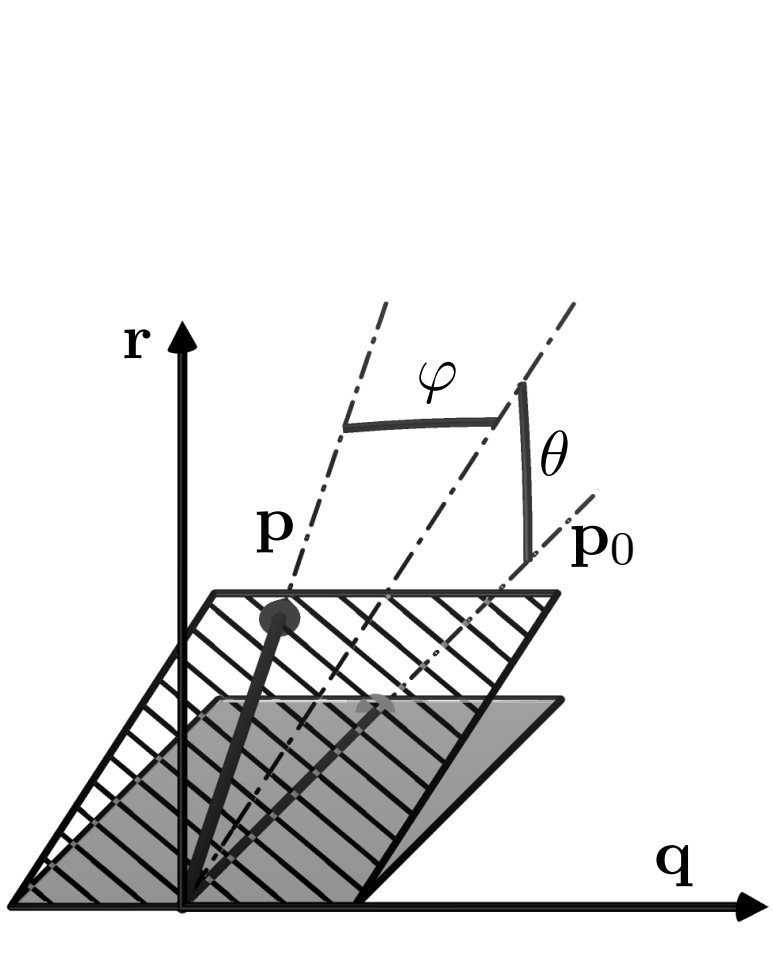


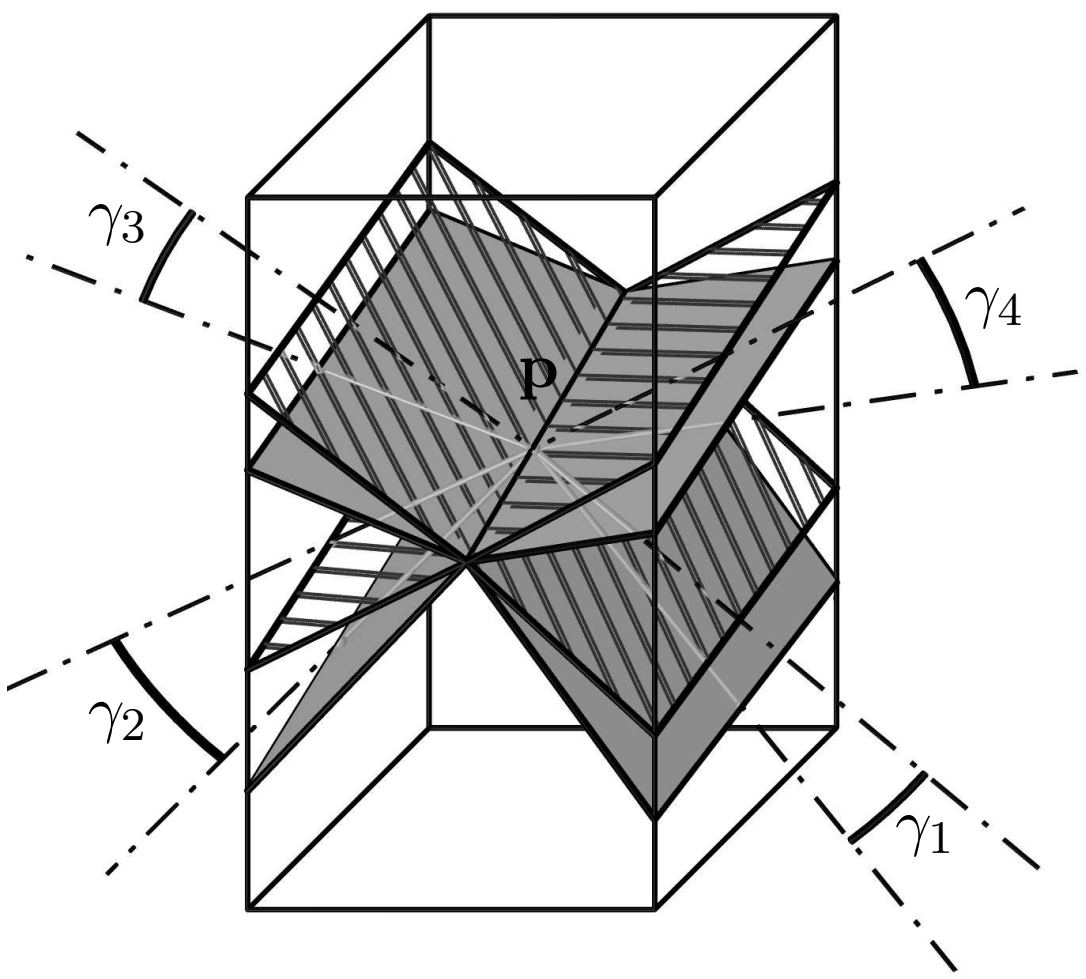
Lambda

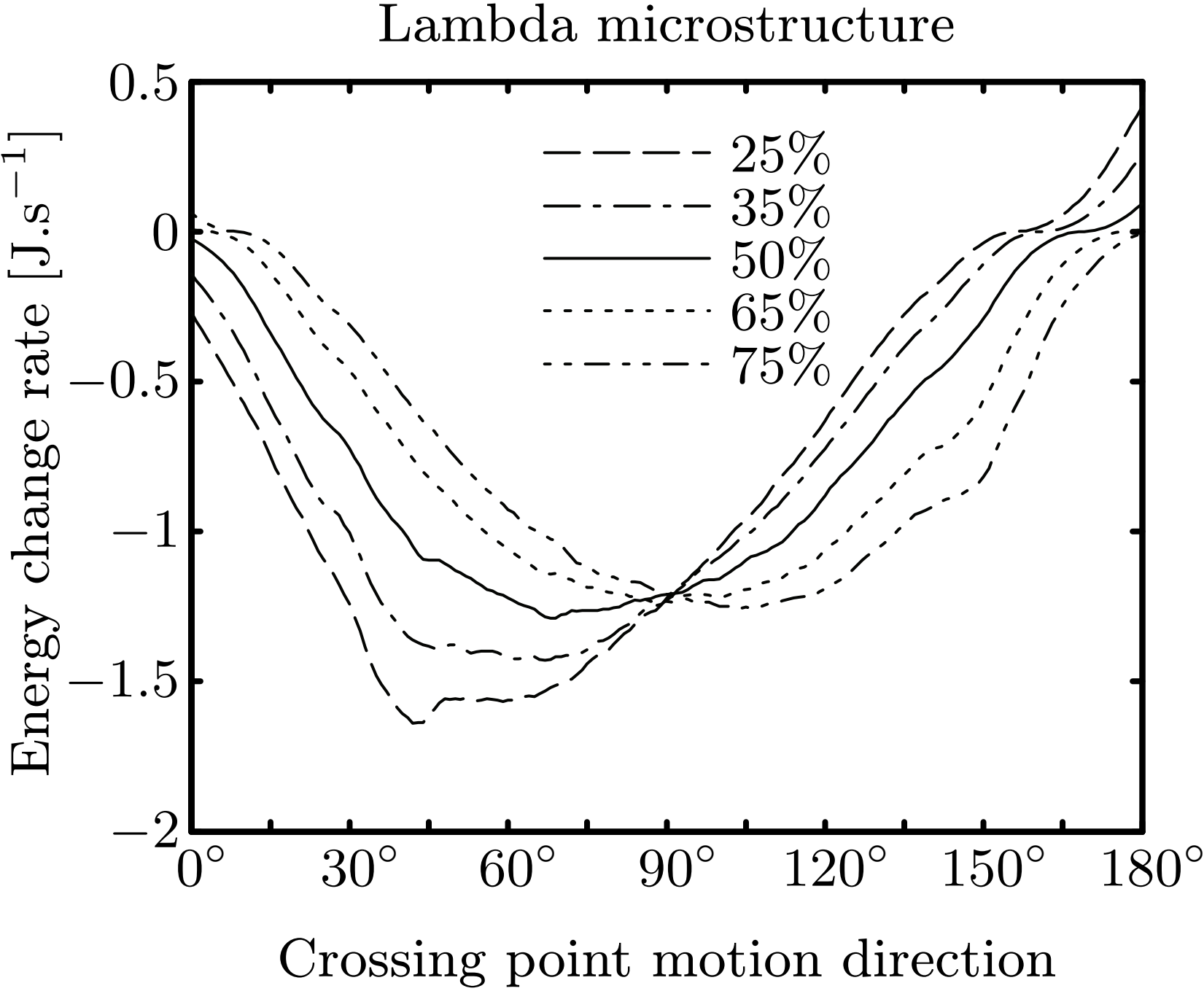


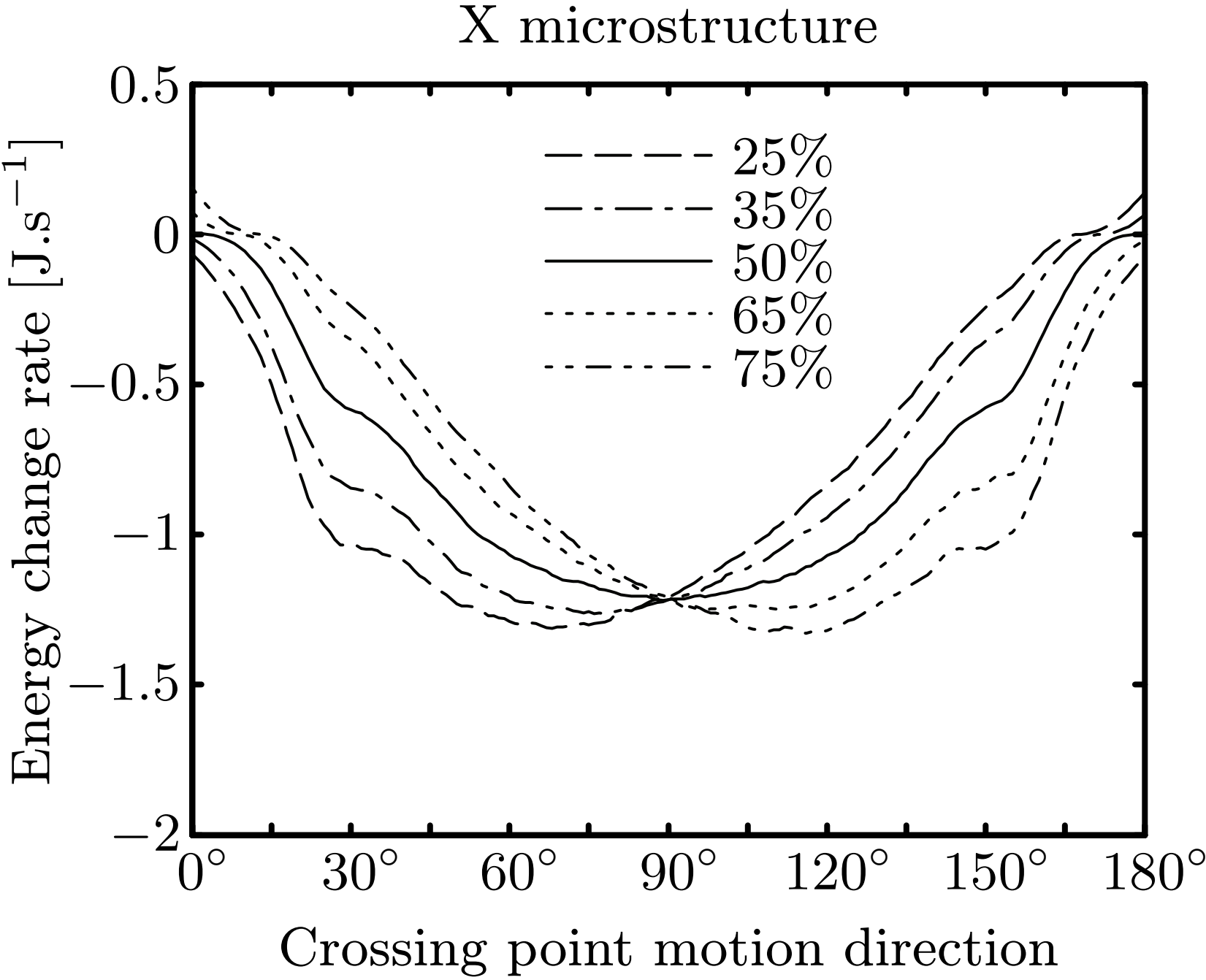
X

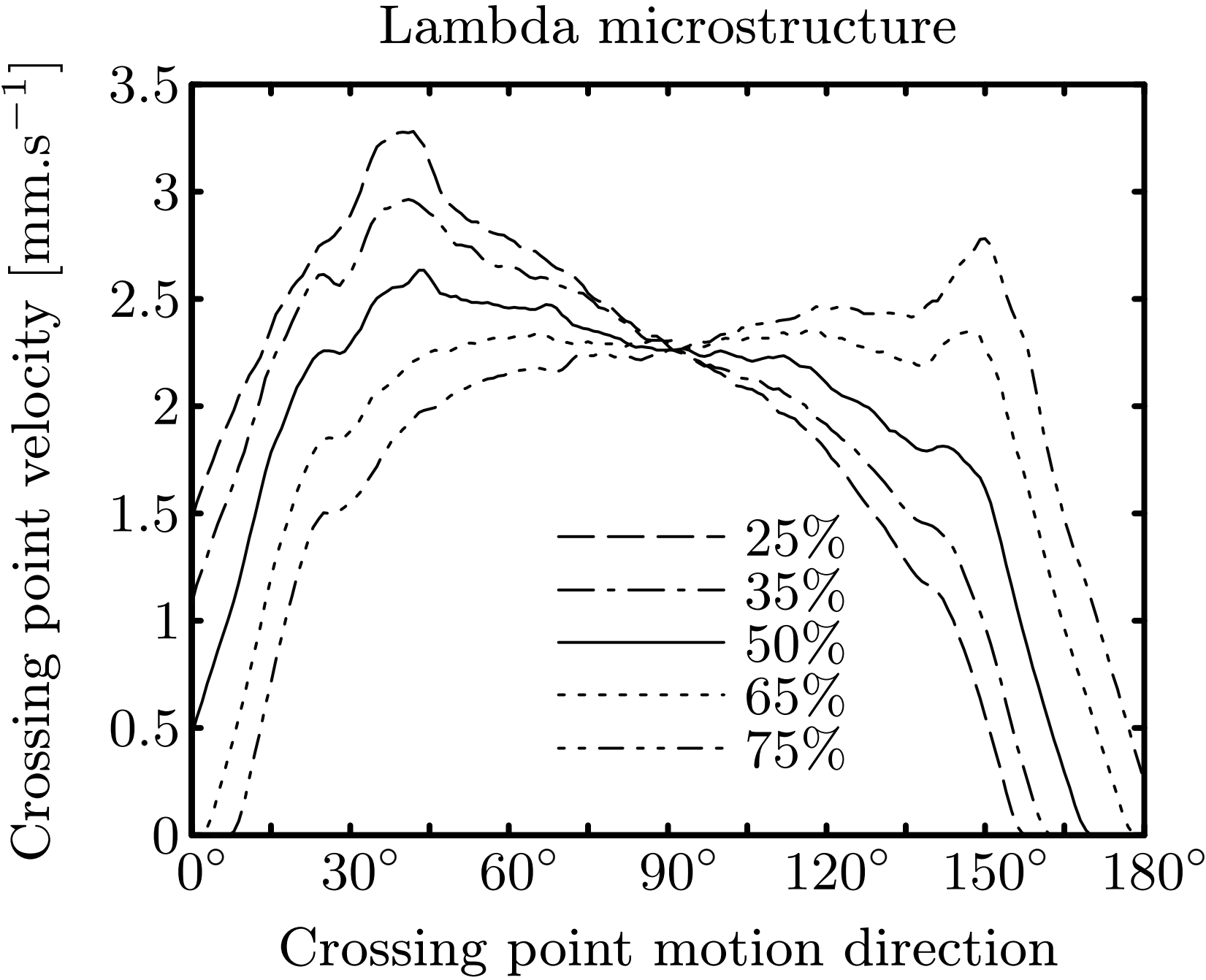

B
$\mathbf{n}_{CB}$
$\mathbf{n}_{AB}$
A
B
A
B
A
B
A
B
C
B
C
B
C
B
C
B
C
$\mathbf{m}_{AB}$
I
$\mathbf{m}_{CB}$

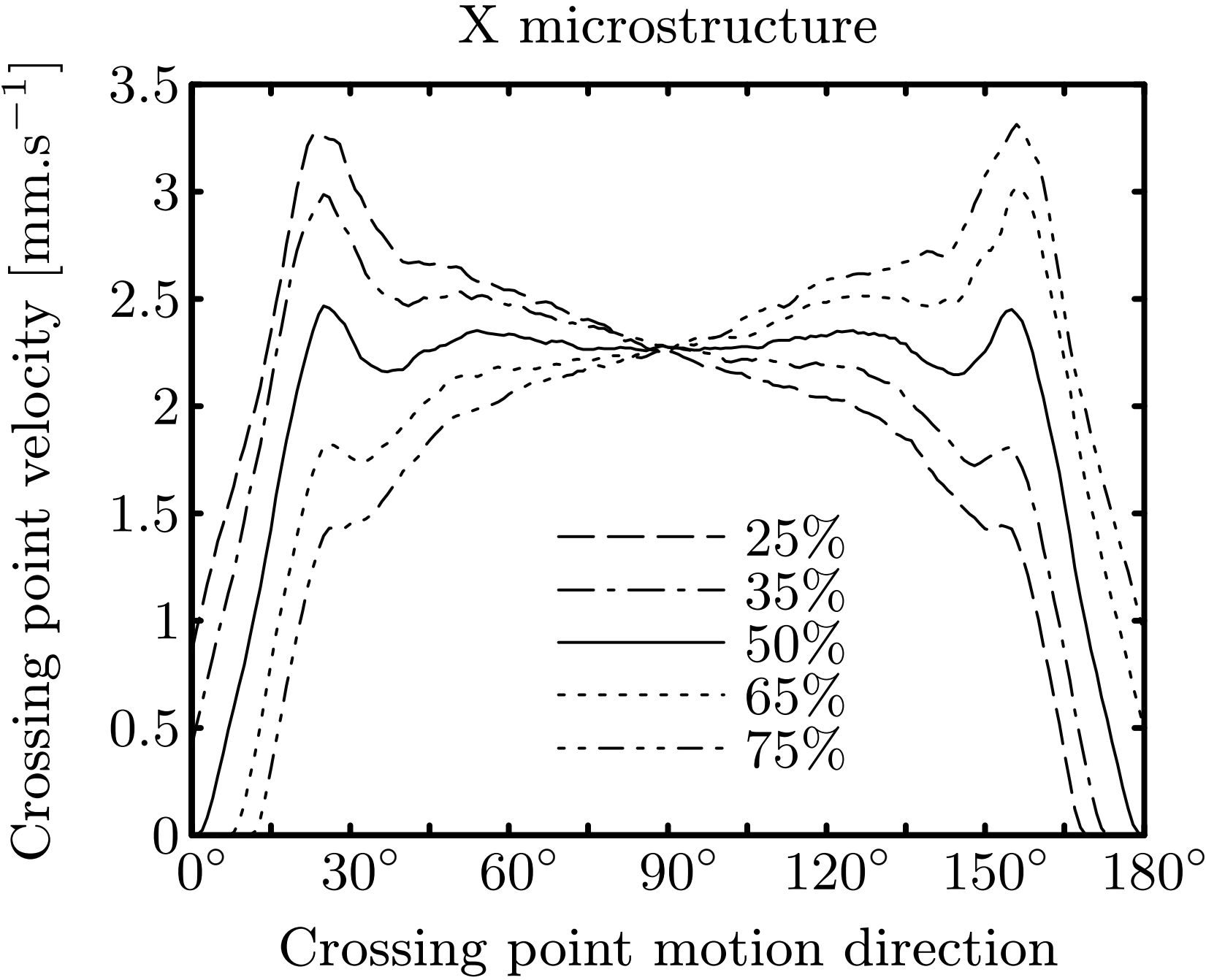

r
φ
θ
p
p0
q

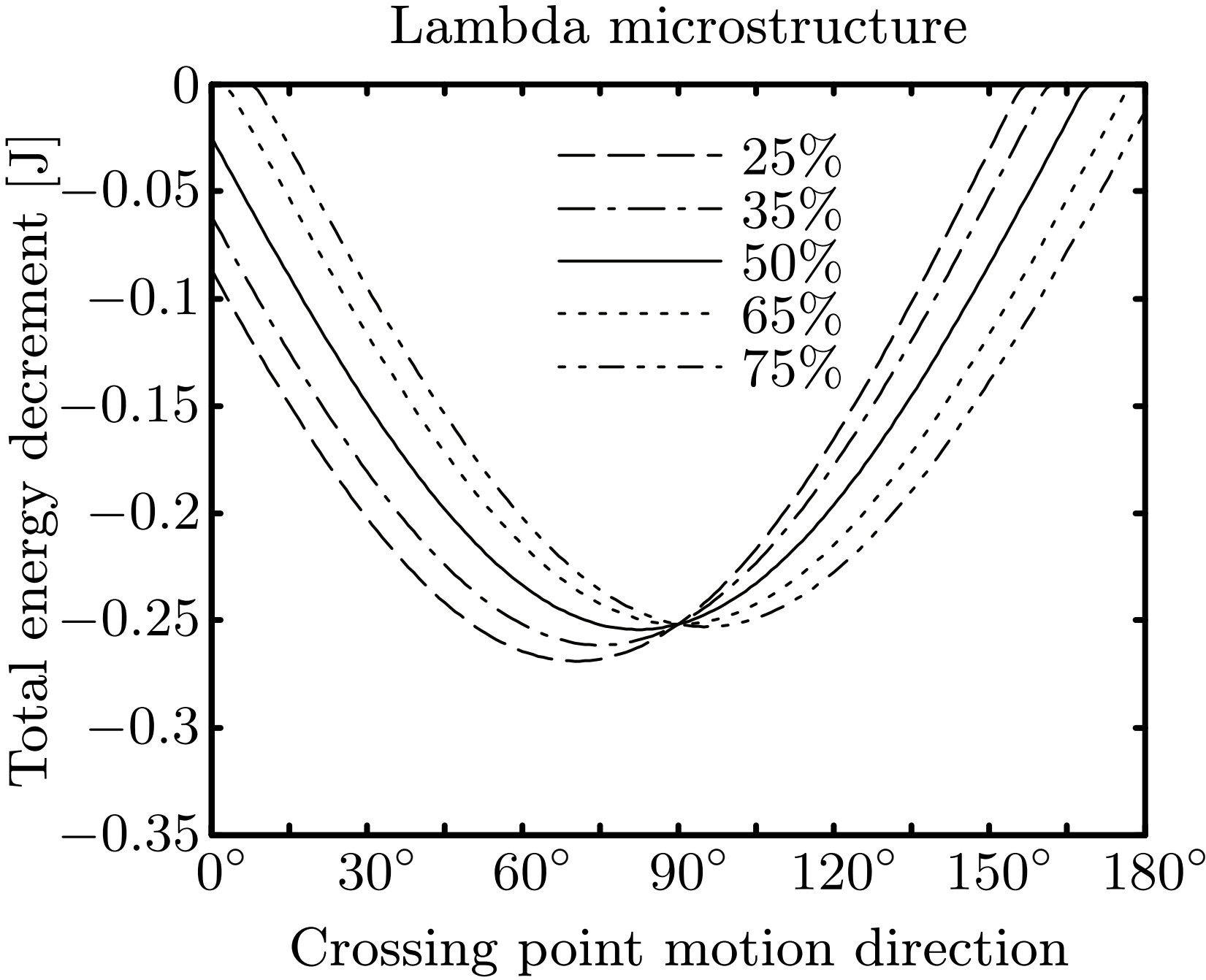

γ3
γ4
p
γ2
γ1

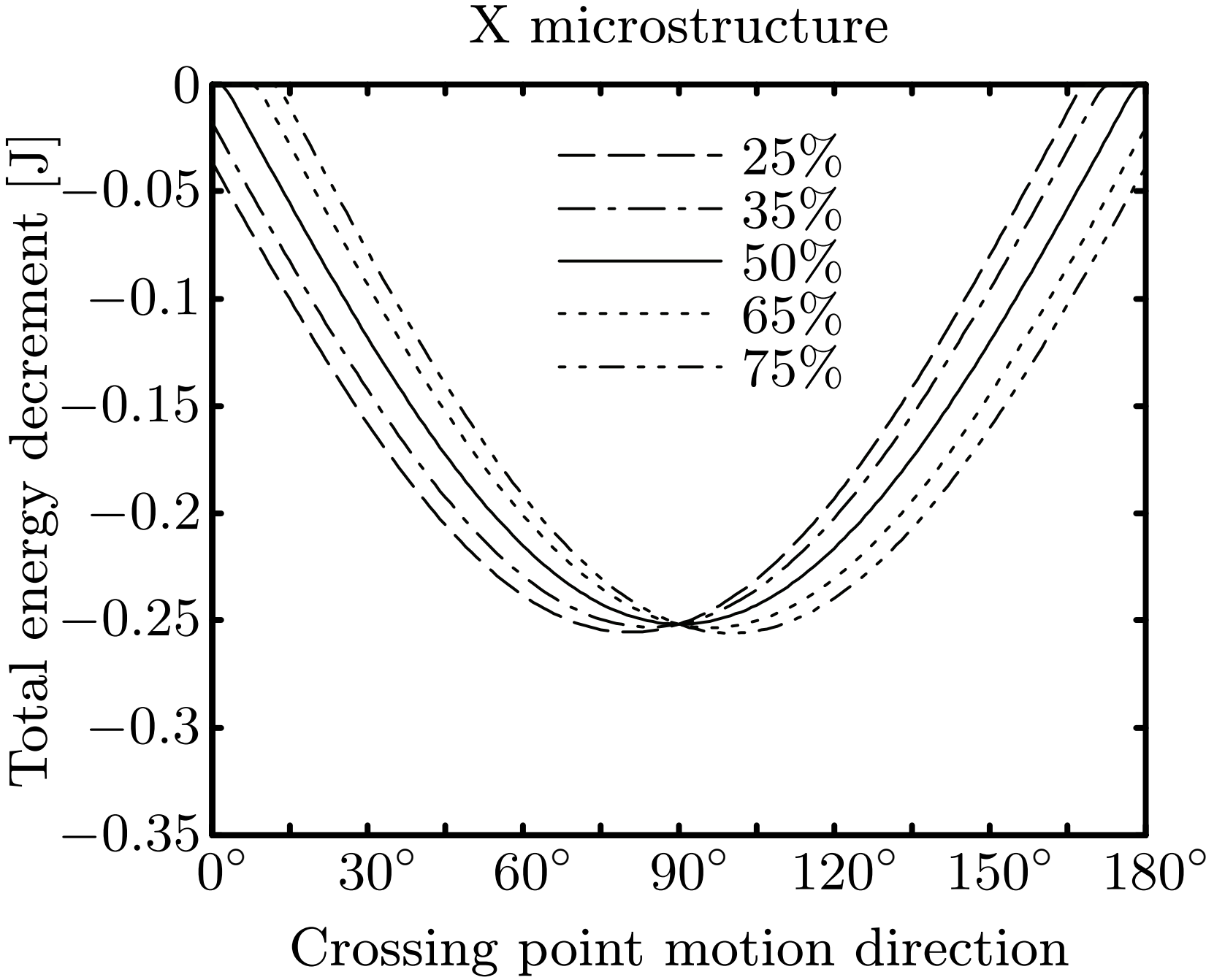

Lambda microstructure
0.5
0
−0.5
−1
−1.5
−2
Energy change rate [J.s$^{-1}$]
25%
35%
50%
65%
75%
0°
30°
60°
90°
120°
150°
180°
Crossing point motion direction

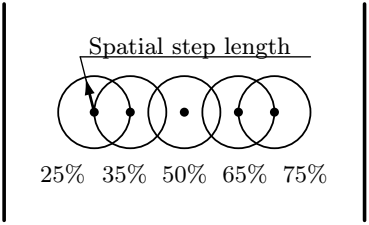

X microstructure
0.5
0
−0.5
−1
−1.5
−2
Energy change rate [J.s$^{-1}$]
25%
35%
50%
65%
75%
0°
30°
60°
90°
120°
150°
180°
Crossing point motion direction

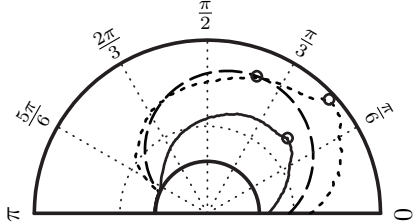

Lambda microstructure
Crossing point velocity [mm.s$^{-1}$]
3.5
3
2.5
2
1.5
1
0.5
0
0°
30°
60°
90°
120°
150°
180°
Crossing point motion direction
25%
35%
50%
65%
75%


X microstructure
Crossing point velocity [mm.s$^{-1}$]
3.5
3
2.5
2
1.5
1
0.5
0
0°
30°
60°
90°
120°
150°
180°
Crossing point motion direction
25%
35%
50%
65%
75%

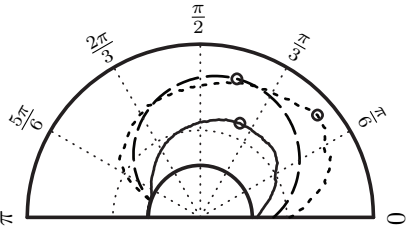

Lambda microstructure
Total energy decrement [J]
0
−0.05
−0.1
−0.15
−0.2
−0.25
−0.3
−0.35
25%
35%
50%
65%
75%
0°
30°
60°
90°
120°
150°
180°
Crossing point motion direction


X microstructure
Total energy decrement [J]
0
−0.05
−0.1
−0.15
−0.2
−0.25
−0.3
−0.35
25%
35%
50%
65%
75%
0°
30°
60°
90°
120°
150°
180°
Crossing point motion direction

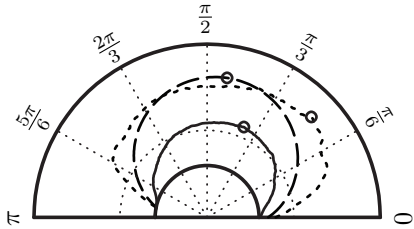


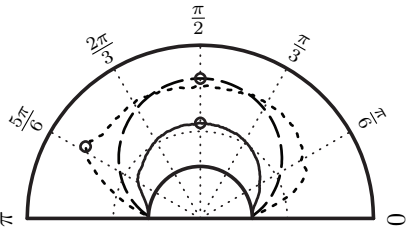

25%



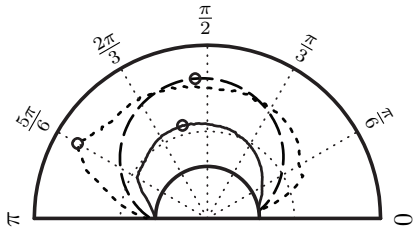

35%




50%




65%

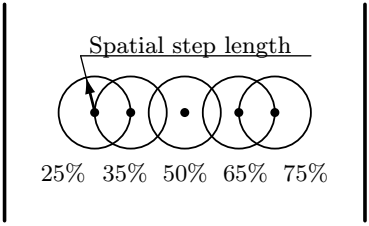


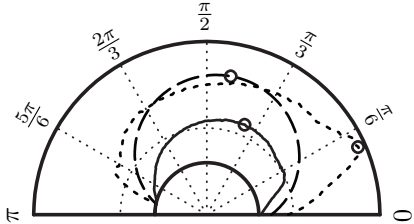

75%

Energy change rate

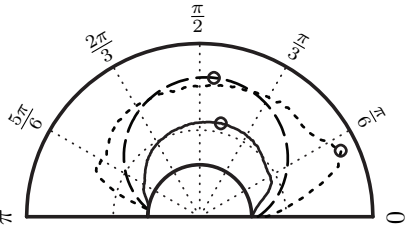
Crossing point velocity

Total energy decrement

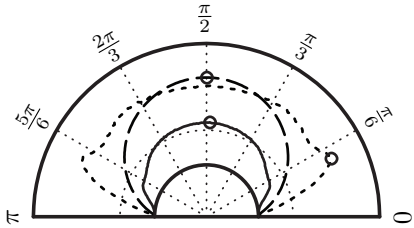


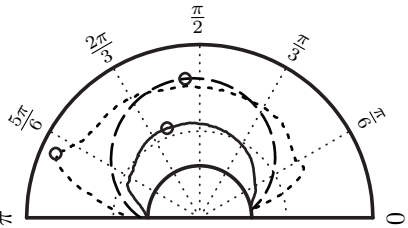

25%



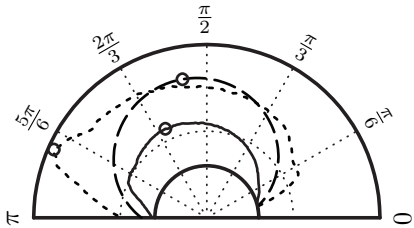

35%




50%




65%

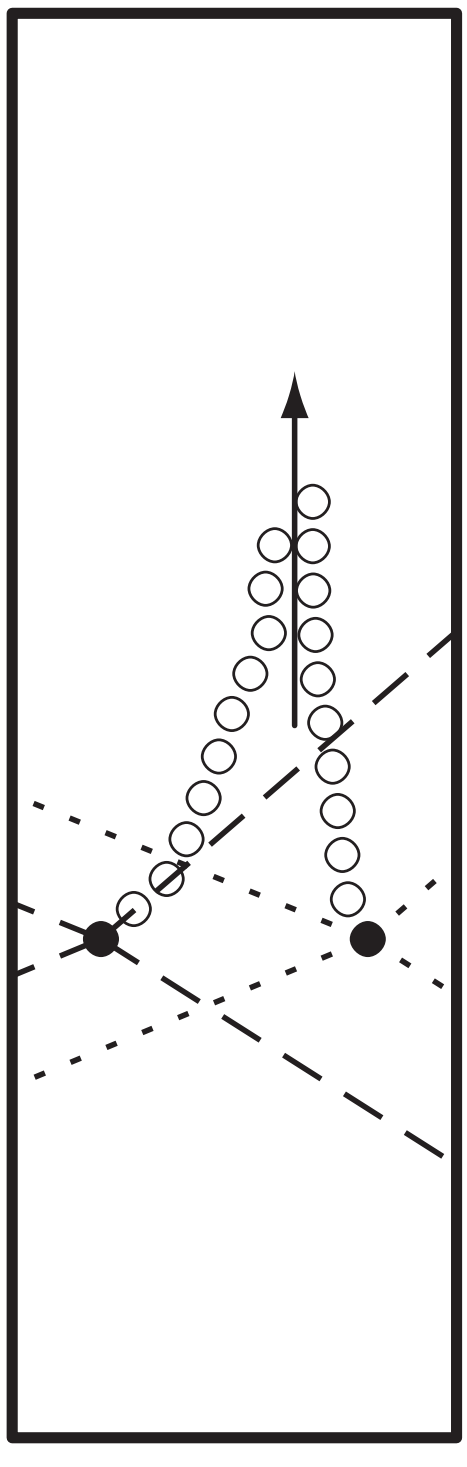



75%

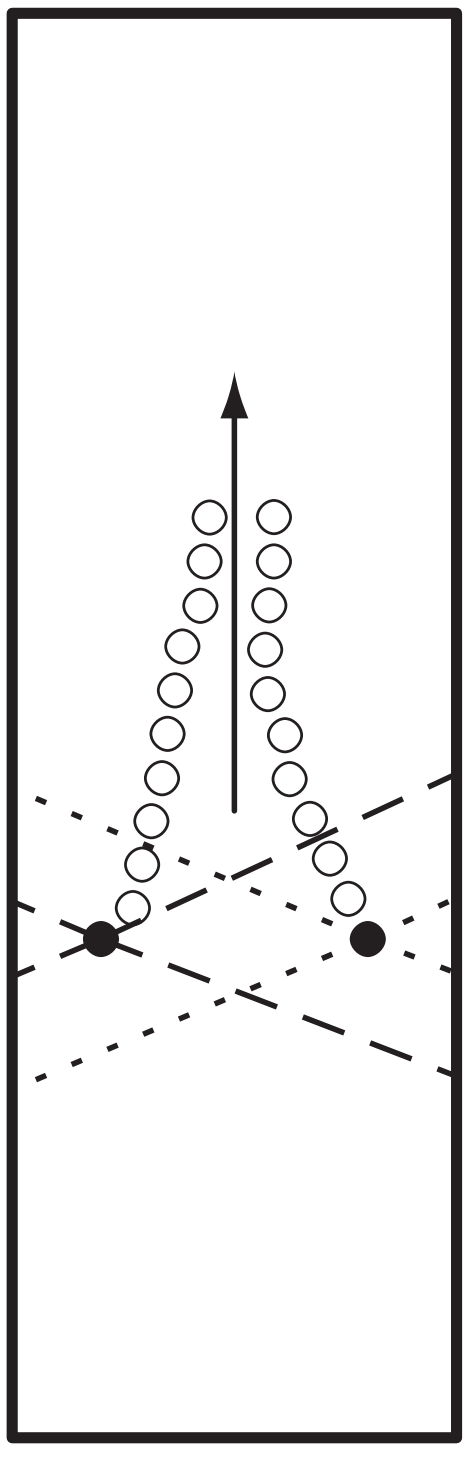
Energy change rate

Crossing point velocity

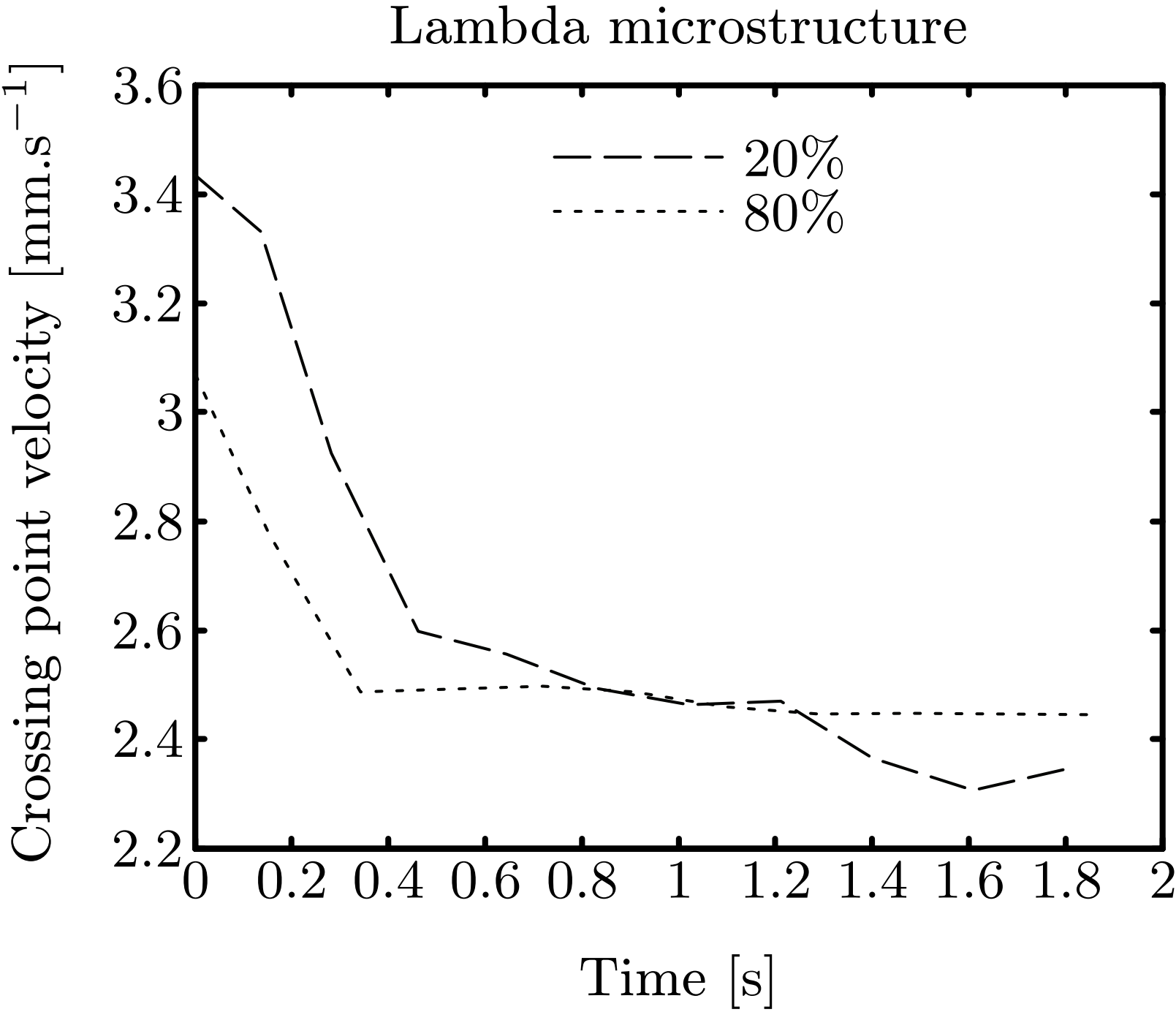
Total energy decrement

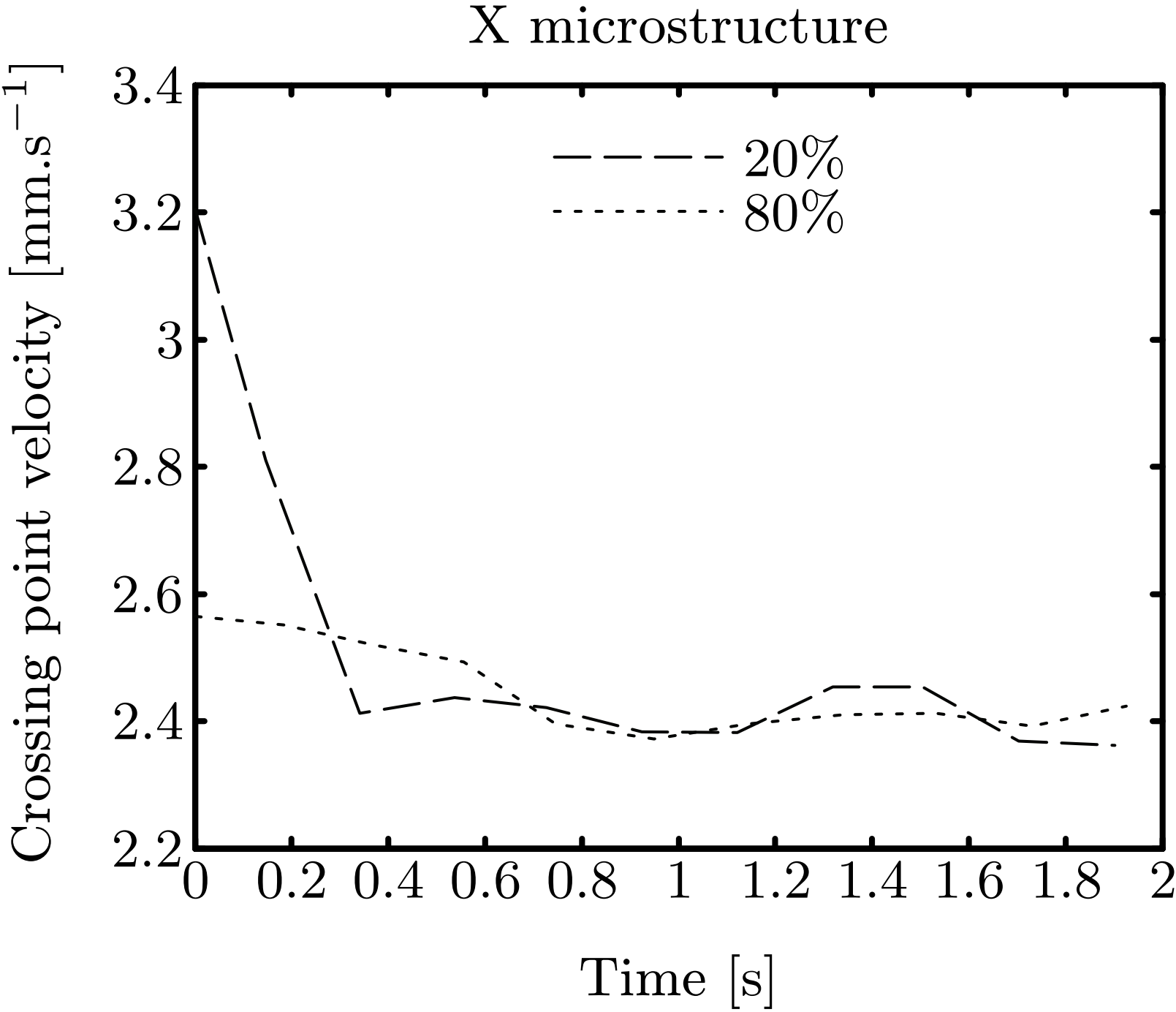


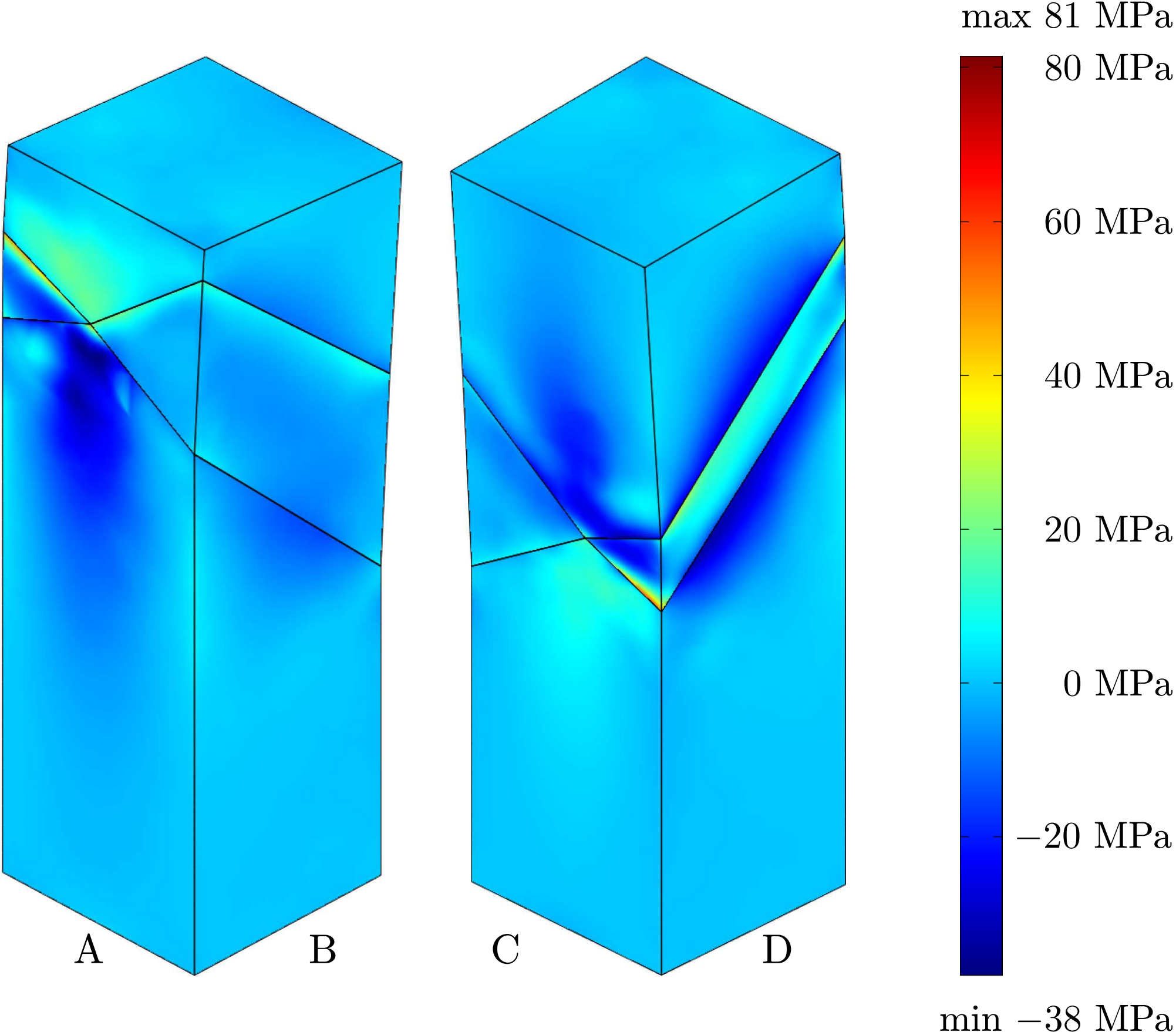
Lambda

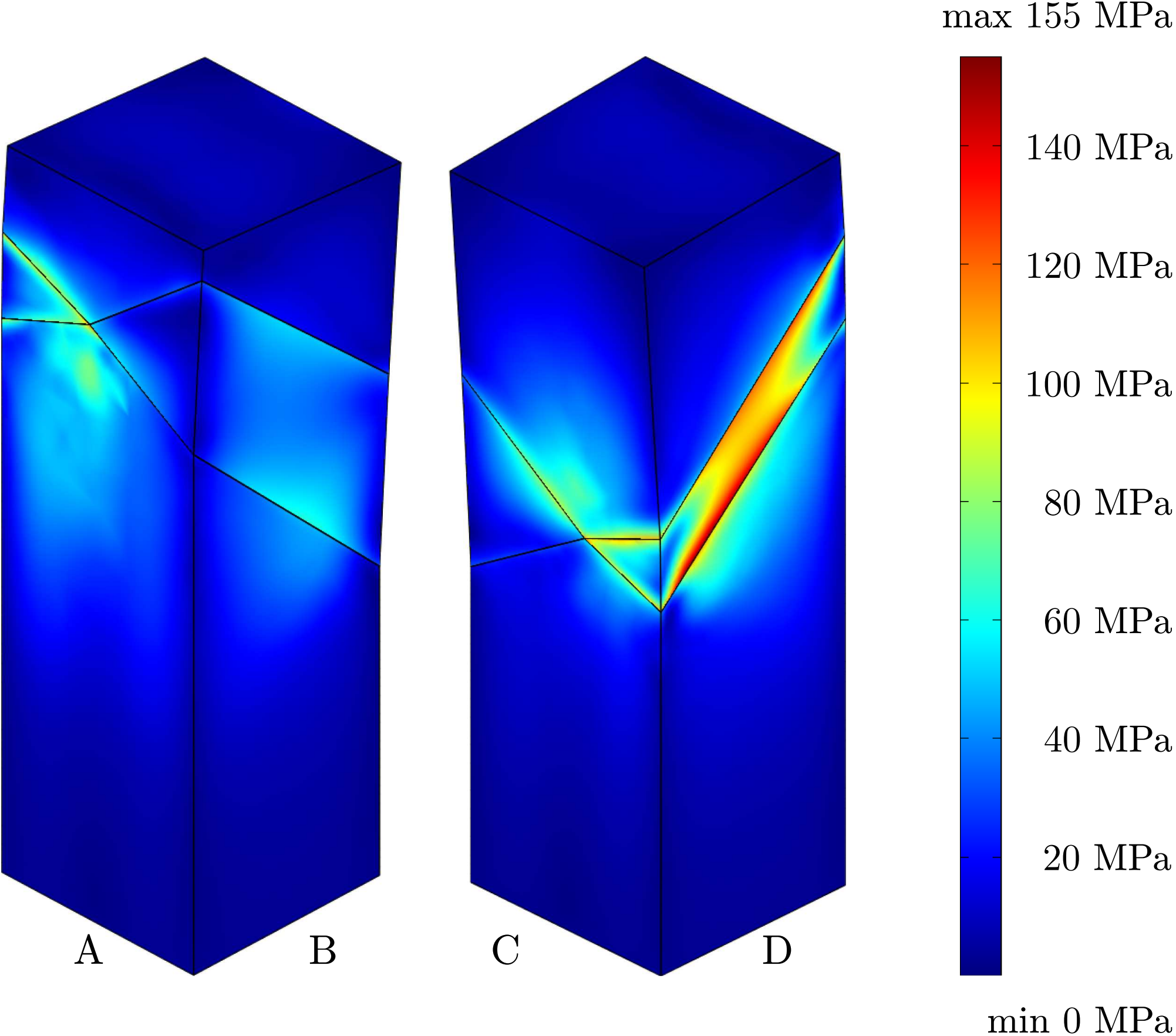


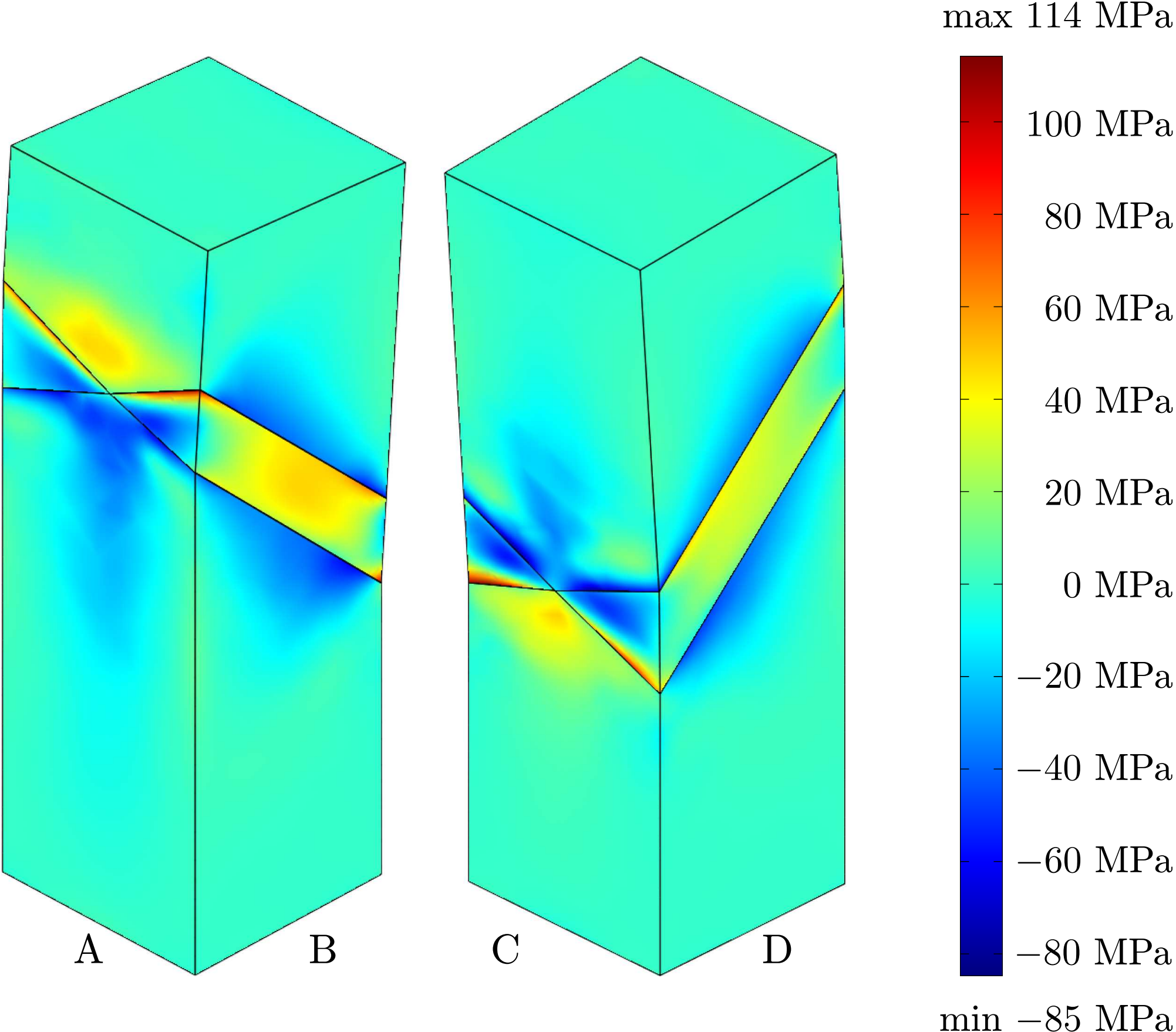
X

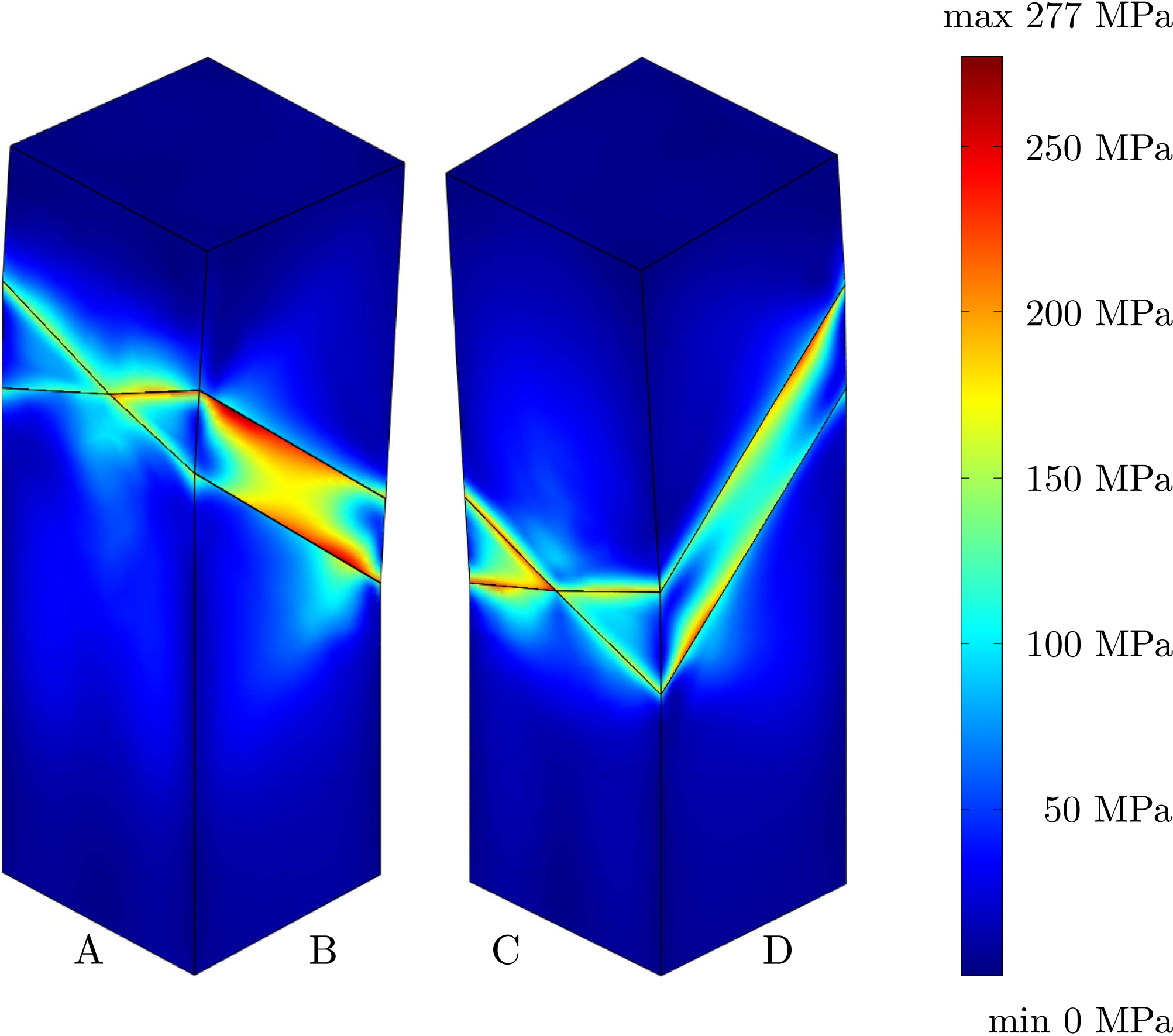

Lambda microstructure
Crossing point velocity [mm.s$^{-1}$]
Time [s]
20%
80%
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2


X microstructure
20%
80%
Crossing point velocity [mm.s$^{-1}$]
Time [s]
3.4
3.2
3
2.8
2.6
2.4
2.2
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2


max 81 MPa
80 MPa
60 MPa
40 MPa
20 MPa
0 MPa
−20 MPa
min −38 MPa
A
B
C
D


max 155 MPa
140 MPa
120 MPa
100 MPa
80 MPa
60 MPa
40 MPa
20 MPa
min 0 MPa
A
B
C
D


max 114 MPa
100 MPa
80 MPa
60 MPa
40 MPa
20 MPa
0 MPa
−20 MPa
−40 MPa
−60 MPa
−80 MPa
min −85 MPa
A
B
C
D


max 277 MPa
250 MPa
200 MPa
150 MPa
100 MPa
50 MPa
min 0 MPa
A
B
C
D