```
In[82]:= (* stability matrix *)
         M = {{-Du * k^2, chi * k^2, 0}, {0, -k^2, 0}, {0, 0, -Dw * k^2}}

In[83]:= (* jacobian matrix *)
         J = {{0, 0, 0}, {fu, fv, fw}, {gu, gv, gw}}

In[84]:= (* characteristic polynomial *)
         P[x_] = -Collect[Det[(M + gamma * J) - x * IdentityMatrix[3]], x]

In[85]:= (* parameters *)

In[86]:= (* Schnackenberg *)


         v0 = a + c + a * e1 + c * e2
         w0 = c * (1 + e2) / (e3 * v0^2)

In[88]:= fv = -1 + 2 v0 w0 * e3

In[89]:= fw = v0^2 * e3

In[90]:= fu = a * e1

In[91]:= gu = c * e2

In[92]:= gv = -2 * v0 * w0 * e3

In[93]:= gw = -v0^2 * e3

In[94]:=

In[95]:= (* the polynomial coefficients *)
         Ak = Collect[-(fv gamma + gamma gw - k^2 - Du k^2 - Dw k^2), {k^2, gamma, chi, Du}]

In[96]:= Bk =
          Collect[-(fw gamma^2 gv - fv gamma^2 gw + chi fu gamma k^2 + Du fv gamma k^2 + Dw fv gamma k^2 +
               gamma gw k^2 + Du gamma gw k^2 - Du k^4 - Dw k^4 - Du Dw k^4), {k^2, gamma, chi, Du}]

In[97]:= Ck =  Collect[
            -chi fw gamma^2 gu k^2 - Du fw gamma^2 gv k^2 + chi fu gamma^2 gw k^2 + Du fv gamma^2 gw k^2 -
              chi Dw fu gamma k^4 - Du Dw fv gamma k^4 - Du gamma gw k^4 + Du Dw k^6, {k^2}]

In[98]:= (* conditions for NOT having PATTERNS *)
         (* Ck > 0*)

In[99]:= b1  =  gamma (-chi Dw fu + Du (-Dw fv - gw))

In[100]:= c1 = gamma^2 (chi (-fw gu + fu gw) + Du (-fw gv + fv gw))

In[101]:= a1 =  Dw

In[102]:= Ckmin  =  -(b1^2 - 4 * a1 * c1) / 4 * a1

In[103]:= (*  (AB-C)_k> 0*)

In[104]:= ABmC = Collect[Ak * Bk - Ck, {k^2}]

In[105]:= a2 = (2 + 4 Dw + 2 Dw^2)
```

```
In[106]:= b2 = Collect[gamma (chi Dw fu + (Dw + Du (1 + Dw)) (- fv - gw) -
            Du (- Dw fv - gw) + (1 + Du + Dw) (- chi fu - Dw fv + Du (- fv - gw) - gw)), {gamma}]

In[107]:= c2 =
           Collect[gamma^2 ((- fv - gw) (- chi fu - Dw fv + Du (- fv - gw) - gw) - chi (- fw gu + fu gw) -
            Du (- fw gv + fv gw) + (1 + Du + Dw) (- fw gv + fv gw)), {gamma}]

In[108]:= (*turning point coordinate *)
          q1 = (- b2 + Sqrt[b2 ^ 2 - 3 * a2 * c2]) / (3 * a2)

In[109]:= ABCmin = fv fw gv - fv^2 gw + fw gv gw - fv gw^2 +
            (chi fu fv + fv^2 + Dw fv^2 + chi fw gu - fw gv - Dw fw gv + 4 fv gw + 2 Dw fv gw + 2 gw^2) q1 +
            (- 2 chi fu - 3 fv - 4 Dw fv - Dw^2 fv - 4 gw - 4 Dw gw) q1 ^ 2 + (2 + 4 Dw + 2 Dw^2) q1 ^ 3

In[111]:=

In[113]:=

In[115]:=

In[117]:= fs = 28
          (* parameters *)
          a = 0.2
          c = 0.2
          Du = 1
          gamma = 2200
          u0 = 1
          Dw = 40;
          f1[e1_, e2_] = c1;
          f2[e1_, e2_] = b1;
          f3[e1_, e2_] = Ckmin;
          nn = 12;

In[128]:= tab = Table[(Evaluate[f1[e1, e2]] ≤ 0 || Evaluate[f2[e1, e2]] ≤ 0) &&
              Evaluate[f3[e1, e2]] ≤ 0, {e3, {10 ^ - 16, 0.05, 0.1, 1}}];


          plotss1 = Table[RegionPlot[Evaluate@tab, {e1, 0, 18}, {e2, 0, 18}, PlotStyle →
               Directive[RGBColor[0.47000000000000003, 0.44, 0.71], Opacity[0.32]],
              BoundaryStyle → Directive[RGBColor[0.47000000000000003, 0.44, 0.71],
                Thickness[0.006]], FrameStyle → Directive[GrayLevel[0],
                fs, FontFamily → "Helvetica", AbsoluteThickness[0.8]],
              FrameTicks → {{{0, 6, 12, 18}, None}, {{0, 6, 12, 18}, None}},
              FrameLabel → {{ToExpression["\\epsilon_{2}", TeXForm, HoldForm], None},
                {ToExpression["\\epsilon_{1}", TeXForm, HoldForm], None}}], {chi, {0.2}}];
```

In[∘]:=

```
comb1 = Show[plotss1];
```

In[134]:=

```
plotss2 = Table[RegionPlot[Evaluate@tab, {e1, 0, nn}, {e2, 0, nn}, PlotStyle →
      Directive[RGBColor[0.47000000000000003, 0.44, 0.71], Opacity[0.32]],
     BoundaryStyle → Directive[RGBColor[0.47000000000000003, 0.44, 0.71],
       Thickness[0.006]], FrameStyle → Directive[GrayLevel[0],
       fs, FontFamily → "Helvetica", AbsoluteThickness[0.8]],
     FrameTicks → {{{0, 4, 8, 12}, None}, {{0, 4, 8, 12}, None}},
     FrameLabel → {{ToExpression["\\epsilon_{2}", TeXForm, HoldForm], None},
       {ToExpression["\\epsilon_{1}", TeXForm, HoldForm], None}}], {chi, {0.5}}];
```

In[∘]:=

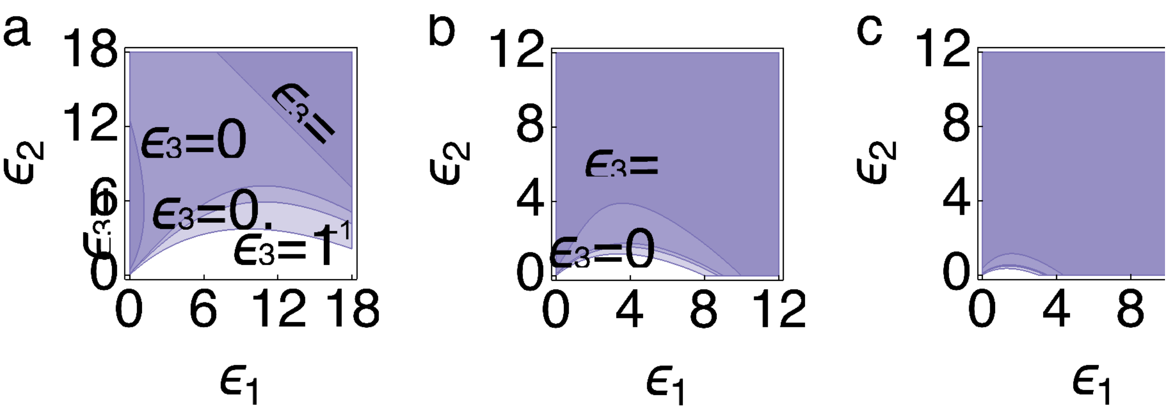
```
comb2 = Show[plotss2];
```

In[∘]:=

```
plotss3 = Table[RegionPlot[Evaluate@tab, {e1, 0, nn}, {e2, 0, nn}, PlotStyle →
      Directive[RGBColor[0.47000000000000003, 0.44, 0.71], Opacity[0.32]],
     BoundaryStyle → Directive[RGBColor[0.47000000000000003, 0.44, 0.71],
       Thickness[0.006]], FrameStyle → Directive[GrayLevel[0],
       fs, FontFamily → "Helvetica", AbsoluteThickness[0.8]],
     FrameTicks → {{{0, 4, 8, 12}, None}, {{0, 4, 8, 12}, None}},
     FrameLabel → {{ToExpression["\\epsilon_{2}", TeXForm, HoldForm], None},
       {ToExpression["\\epsilon_{1}", TeXForm, HoldForm], None}}], {chi, {1}}];


comb3 = Show[plotss3];

new = {Show[comb1], Show[comb2], Show[comb3]};
Show[GraphicsRow[new, Spacings → Scaled[0.15], ImageSize → 1000]]
```



In[•]:=

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