

$$\text{matC} = \begin{pmatrix} 1 & -2 & 3 \\ 0 & 6 & 1 \\ 3 & 0 & 9 + 10i \end{pmatrix};$$

n = 3;

estimateEval[B_, α_, showMarkers_?BooleanQ, showLabel_?BooleanQ] :=

Module[{A, A1, A2, eval, circles, circleCentres, evalPoints},

Assert[α ≥ 0 && α ≤ 1, "α must be in the range [0;1]"];

A1 = DiagonalMatrix[Diagonal[B]];

A2 = B - DiagonalMatrix[Diagonal[B]];

A = A1 + α * A2;

eval = Eigenvalues[A] // N;

circles = Table[

Circle[{Re[A[[i, i]]], Im[A[[i, i]]]}, Total[Abs[A[[i, Cases[Range[1, n], x_ /; x ≠ i]]]]],

{i, 1, n}];

circleCentres = Table[

Callout[

{Re[A[[i, i]]], Im[A[[i, i]]]},

Subscript["d", ToString[i] <> ToString[i]]

],

{i, 1, n}];

evalPoints = Table[

Callout[

{Re[eval[[i]]], Im[eval[[i]]]},

Subscript["λ", i],

{Re[eval[[i]]] - 0.8, Im[eval[[i]]] + 0.8}


],

{i, 1, n} // N;

Show[

ListPlot[{ circleCentres showMarkers
 [(#1[[1]]) & /@ circleCentres True ,

PlotRange → {{-5, 14}, {-6, 14}},

PlotStyle → ,

PlotMarkers → {"♦", 14},

AxesLabel → {"Re", "Im"},

ImageSize → Large,

BaseStyle → {FontSize → 14},

AspectRatio -> Automatic,

PlotLabel → { "α = " <> ToString[Round[α, 0.01]] showLabel
 "" True


],

ListPlot[{ evalPoints showMarkers
 [(#1[[1]]) & /@ evalPoints True , PlotStyle → , PlotMarkers → {"●", 12}],

Legended[

Graphics[

{

, Thickness[0.004], circles,

Opacity[0.1], Disk@@@ circles

}

]

,

PointLegend[, , {"Circle centre", "Eigenvalue"}],

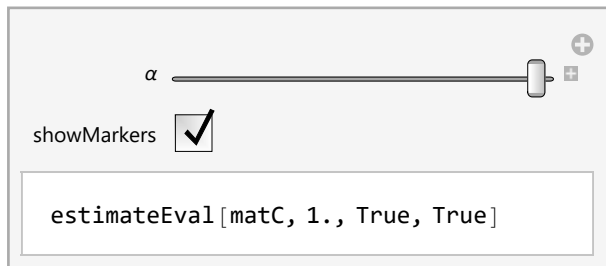
LegendMarkerSize → 14, LegendMarkers → {"♦", 14}, {"●", 11}]

]

]

]

```
Manipulate[
  estimateEval[matC,  $\alpha$ , showMarkers, True]
  , { $\alpha$ , 0, 1}, {showMarkers, {True, False}}
```



```
(*Export[FileNameJoin[{NotebookDirectory[], "frames/showMarker=0alpha=00.png"}],
  Table[estimateEval[matC,  $\alpha$ , False, True], { $\alpha$ , 0, 1, 0.05}], "VideoFrames", Antialiasing->True];
Export[FileNameJoin[{NotebookDirectory[], "frames/showMarker=1alpha=00.png"}],
  Table[estimateEval[matC,  $\alpha$ , True, True], { $\alpha$ , 0, 1, 0.05}], "VideoFrames", Antialiasing->True];*)
```

Eigenvalues $\left[\begin{pmatrix} f_{11} & 0 \\ 0 & f_{22} \end{pmatrix} + \alpha \begin{pmatrix} 0 & f_{12} \\ f_{21} & 0 \end{pmatrix} \right]$

$\left\{ \frac{1}{2} \left(f_{11} + f_{22} - \sqrt{f_{11}^2 + 4 \alpha^2 f_{12} f_{21} - 2 f_{11} f_{22} + f_{22}^2} \right), \frac{1}{2} \left(f_{11} + f_{22} + \sqrt{f_{11}^2 + 4 \alpha^2 f_{12} f_{21} - 2 f_{11} f_{22} + f_{22}^2} \right) \right\}$

```
estimateEval[matC, 1, True, False]
```

