In[ ]:=
```
ClearAll["Global`*"]
```

erif_TESTS

Difference between Normal and VonMises distribution

Hi-density function in the paper. *periodic

> ρ in the paper -90 ~ +90

> ρ in Mathematica: -180 ~ +180

Hii-PDF

In degree (do not sue)

In radian

In[ ]:=
```
rho[θ_, b_] := 4 * Sqrt[b / (2 π)] * Exp[b * (Cos[2 θ] + 1)] / Erfi[Sqrt[2 b]]
kappa[b_] := 1 / 4 * Integrate[ρ[θ, b] * Sin[θ]^3, {θ, 0, π}]
```

In[ ]:=
```
findroot[target_] := FindRoot[kappa[b] == target, {b, 0.01}];
```

In[ ]:=
```
kappalist = {0.33, 0.3, 0.2, 0.15, 0.1, 0.05}
wb = findroot /@ kappalist;
wb = Table[wb[[i, 1, 2]], {i, 1, 6}]
```

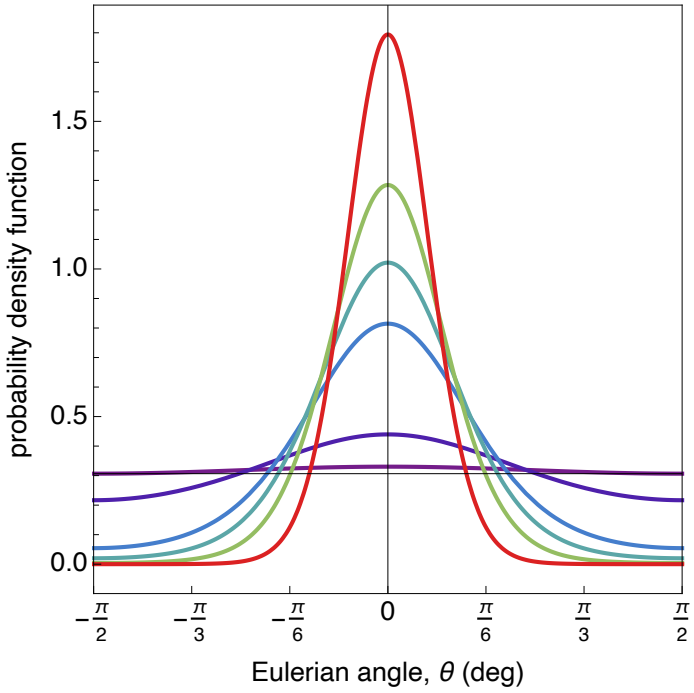
Out[ ]= {0.33, 0.3, 0.2, 0.15, 0.1, 0.05}

Out[ ]= {0.0372385, 0.353871, 1.35461, 1.96673, 2.89849, 5.32972}

In[ ]:=
```
pdf[θ_, b_] := rho[θ , b] / NIntegrate[rho[x , b], {x, -π / 2, π / 2}]
```

In[•]:=
```
klist = {0.33, 0.3, 0.2, 0.15, 0.1, 0.05};
pdfAll = Show[
  Table[
   Plot[pdf[θ , t], {θ, -π / 2, π / 2},
    PlotRange → {{-π / 2, π / 2}, All},
    PlotStyle → {Thickness[0.007], ColorData["Rainbow"][t / Max[wb]]},
    FrameTicks → {{Automatic, None}, {Table[π / 6 i, {i, -3, 3}], None}},
    LabelStyle → {FontSize → 14, FontFamily → "Helvetica", Black},
    Frame → True,
    FrameLabel → {"Eulerian angle, θ (deg)", "probability density function"},
    AspectRatio → 1 / 1
   ],
   {t, wb}
  ],
  PlotRange → {{-π / 2, π / 2}, All}]
```

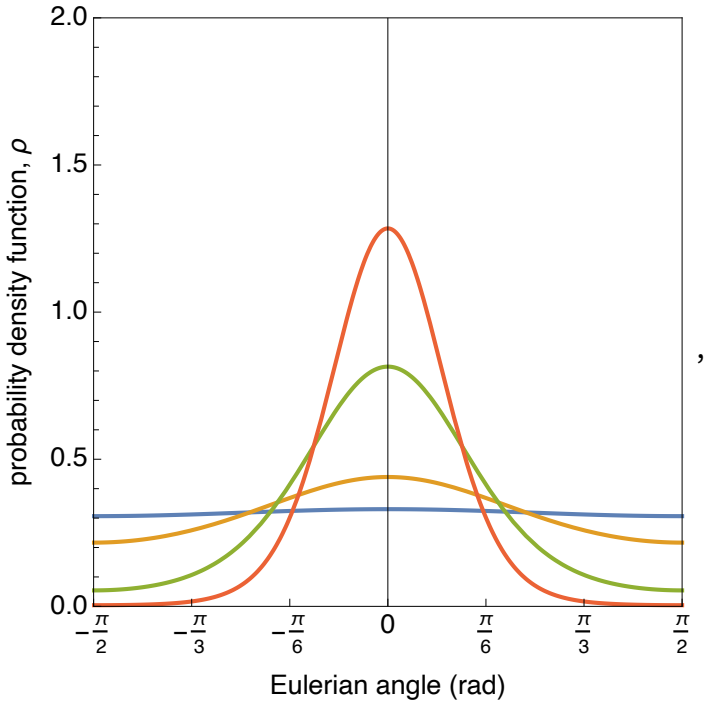
Out[•]=



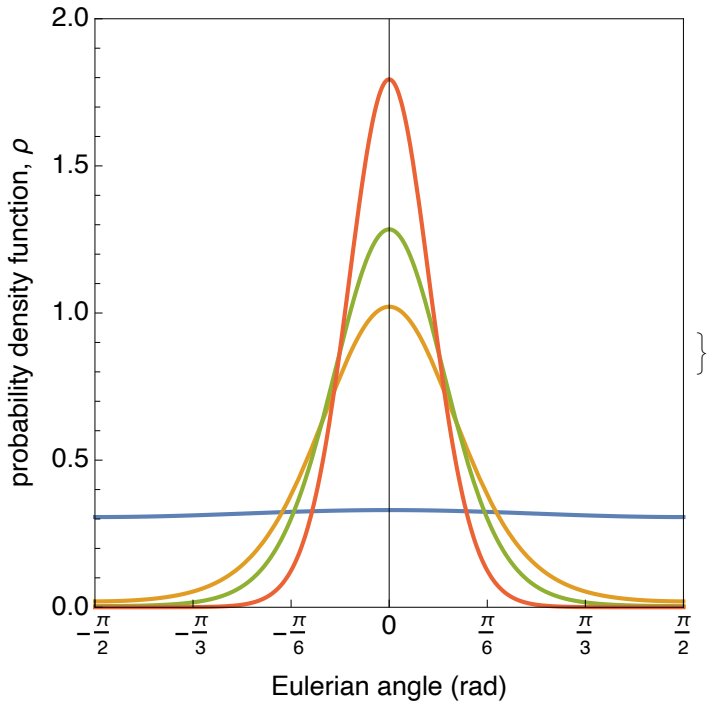
In[•]:=
```
pdf1[θ_] := pdf[θ, wb[[1]]](*kappa=0.33*)
pdf2[θ_] := pdf[θ, wb[[2]]](*kappa=0.3*)
pdf3[θ_] := pdf[θ, wb[[3]]](*kappa=0.2*)
pdf4[θ_] := pdf[θ, wb[[4]]](*kappa=0.15*)
pdf5[θ_] := pdf[θ, wb[[5]]](*kappa=0.1*)
pdf6[θ_] := pdf[θ, wb[[6]]](*kappa=0.05*)
```

In[•]:=
```
(*w1: kappa=(0.33, 0.3, 0.2, 0.1) → 1,2,3,5*)
pw1 = Plot[{pdf1[θ], pdf2[θ], pdf3[θ], pdf5[θ]}, {θ, -π / 2, π / 2},
   PlotRange → {{-π / 2, π / 2}, {0, 2}},
   FrameTicks → {{Automatic, None}, {Table[π / 6 i, {i, -3, 3}], None}},
   LabelStyle → {FontSize → 14, FontFamily → "Helvetica", Black},
   Frame → True,
   FrameLabel → {"Eulerian angle (rad)", "probability density function, ρ"},
   AspectRatio → 1 / 1,
   PlotStyle → {Thickness[0.007]},
   ImageSize → Medium
  ];
(*w0: kappa=(0.33, 0.15, 0.1, 0.05) → 1,4,5,6*)
pw0 = Plot[{pdf1[θ], pdf4[θ], pdf5[θ], pdf6[θ]}, {θ, -π / 2, π / 2},
   PlotRange → {{-π / 2, π / 2}, {0, 2}},
   FrameTicks → {{Automatic, None}, {Table[π / 6 i, {i, -3, 3}], None}},
   LabelStyle → {FontSize → 14, FontFamily → "Helvetica", Black},
   Frame → True,
   FrameLabel → {"Eulerian angle (rad)", "probability density function, ρ"},
   AspectRatio → 1 / 1,
   PlotStyle → {Thickness[0.007]},
   ImageSize → Medium
  ];
{pw1, pw0}
```

Out[•]=

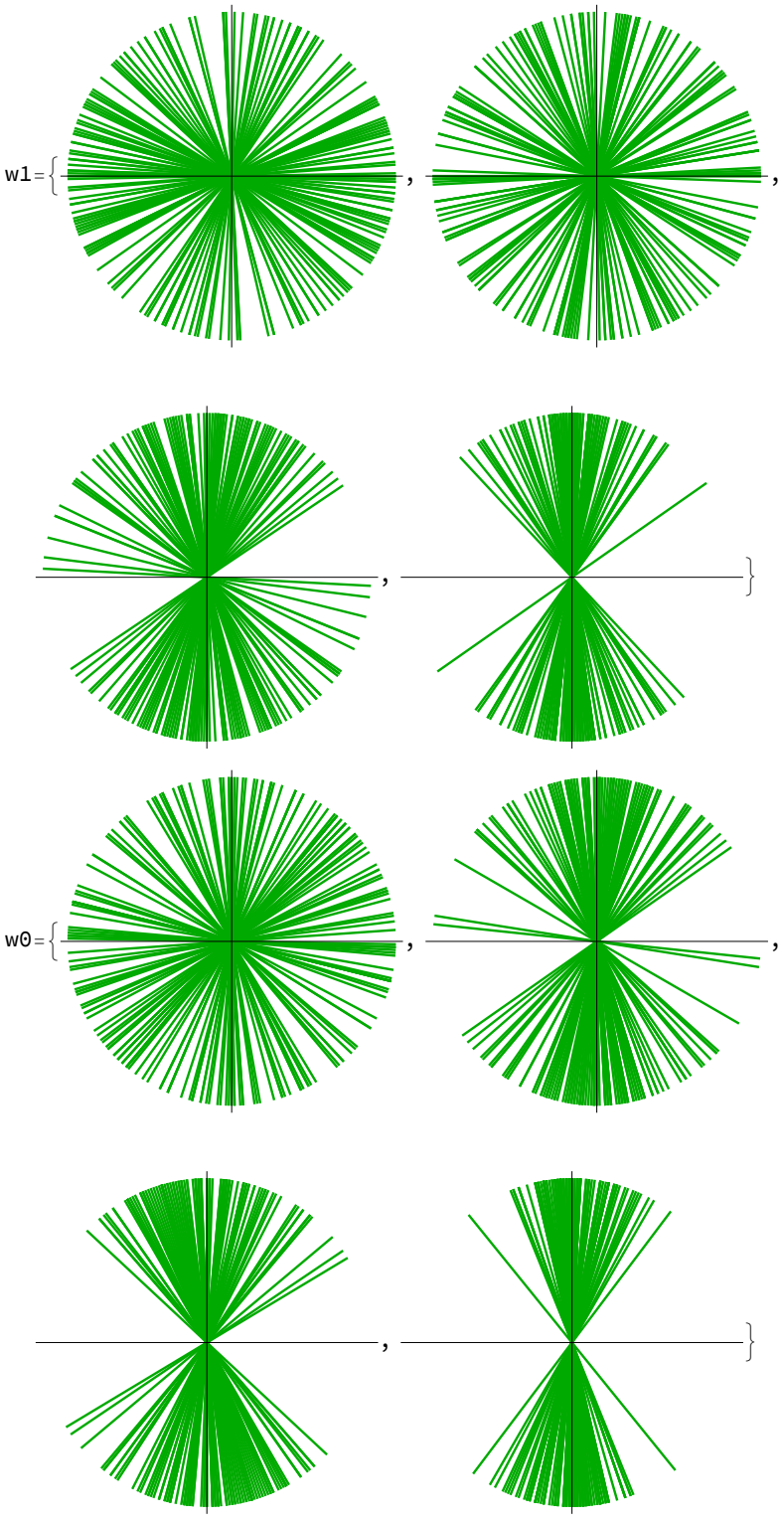

2.0
1.5
1.0
0.5
0.0
probability density function, ρ
−π/2
−π/3
−π/6
0
π/6
π/3
π/2
Eulerian angle (rad)

,


2.0
1.5
1.0
0.5
0.0
probability density function, ρ
−π/2
−π/3
−π/6
0
π/6
π/3
π/2
Eulerian angle (rad)

}

```
In[ ]:= NIntegrate[pdf1[x], {x, -π / 2, π / 2}];
        NIntegrate[pdf2[x], {x, -π / 2, π / 2}];
        NIntegrate[pdf3[x], {x, -π / 2, π / 2}];
        NIntegrate[pdf4[x], {x, -π / 2, π / 2}];
        NIntegrate[pdf5[x], {x, -π / 2, π / 2}];
        NIntegrate[pdf6[x], {x, -π / 2, π / 2}];

In[ ]:= D1 = ProbabilityDistribution[pdf1[x], {x, -π / 2, π / 2}];(*kappa=0.33*)
        D2 = ProbabilityDistribution[pdf2[x], {x, -π / 2, π / 2}];(*kappa=0.3*)
        D3 = ProbabilityDistribution[pdf3[x], {x, -π / 2, π / 2}];(*kappa=0.2*)
        D4 = ProbabilityDistribution[pdf4[x], {x, -π / 2, π / 2}];(*kappa=0.15*)
        D5 = ProbabilityDistribution[pdf5[x], {x, -π / 2, π / 2}];(*kappa=0.1*)
        D6 = ProbabilityDistribution[pdf6[x], {x, -π / 2, π / 2}];(*kappa=0.05*)


In[ ]:= (*w1: kappa=(0.33, 0.3, 0.2, 0.1) → 1,2,3,5*)
        (*w0: kappa=(0.33, 0.15, 0.1, 0.05) → 1,4,5,6*)
        n = 100;
        w1Fang = Round[RandomVariate[D1, n] * 180 / π + 90, 1];
        w1FEang = Round[RandomVariate[D2, n] * 180 / π + 90, 1];
        w1E1ang = Round[RandomVariate[D3, n] * 180 / π + 90, 1];
        w1E2ang = Round[RandomVariate[D5, n] * 180 / π + 90, 1];

        w0Fang = Round[RandomVariate[D1, n] * 180 / π + 90, 1];
        w0FEang = Round[RandomVariate[D4, n] * 180 / π + 90, 1];
        w0E1ang = Round[RandomVariate[D5, n] * 180 / π + 90, 1];
        w0E2ang = Round[RandomVariate[D6, n] * 180 / π + 90, 1];

In[ ]:= AngleLine[x_] := {{Re[Exp[I x Degree]], Im[Exp[I x Degree]]},
           {Re[Exp[I (x + 180) Degree]], Im[Exp[I (x + 180) Degree]]}};
        (*x here should be in degree*)
        fiberDist[list_] :=
         Module[{x = list},
          ListLinePlot[Table[AngleLine /@ x],
           PlotRange → {{-1.05, 1.05}, {-1.05, 1.05}}, AspectRatio → 1, ImageSize → Small,
           PlotStyle → Directive[{Darker[Green], Thickness[0.007]}], Ticks → None]
         ]

In[ ]:= Print["w1=", {fiberDist[w1Fang],
          fiberDist[w1FEang], fiberDist[w1E1ang], fiberDist[w1E2ang]}]
        Print["w0=", {fiberDist[w0Fang], fiberDist[w0FEang],
          fiberDist[w0E1ang], fiberDist[w0E2ang]}]
```


w1=
w0=