Wydruk programu ,,Swiatlowod” do wytworzenia rysunków do zakrzywionego światłowodu

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Exit[]
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```
KadaptRK3BS[XY_] :=
 Module[{k1, k2, k3, k4, x = First@XY, Y = Drop[XY, 1], ΔY23, Δk, hstare},
  hstare = h;
  k1 = h FIO;
  k2 = h F[x + 1/2 h, ##] &@@ (Y + 1/2 k1);
  k3 = h F[x + 3/4 h, ##] &@@ (Y + 3/4 k2);
  Y3 = Y + (2/9 k1 + 1/3 k2 + 4/9 k3);
  FIO = F[x + h, ##] &@@ Y3;
  k4 = h FIO;
  ΔY23 = Abs[1/72 (5 k1 - 6 k2 - 8 k3 + 9 k4)];
  Δk = Max@(ΔY23/(Abs[Y3] + Abs[Y3 - Y]));
  h = hstare If[δ > Δk, Min[(δ/Δk)^(1/3), 5], Max[(δ/Δk)^(1/3), 1/5]];
  ndone++;
  Flatten@{x + hstare, Y3}]
```

```
makeGraph[iniDat_: {-6, -1.5, π/180 80, 0}, P_: 0.8, λ_: 400] :=
 Module[{graf, hstart, ν, dνx, dνy, λ1 = 400, λ2 = 720,
   ϵ = 0.2, kolor = ColorData["VisibleSpectrum"][λ]},
  {w = 6, k = 3, ro = 2, aa = ro/3, bb = 1};
  Clear[f];
  f[x_] = If[-1 < x < 1, (1 - (x^2)^k)^(2 k), 0];
  n1 = 1 + P f[(Sqrt[x^2 + y^2] - ro)/aa];
  nn[x_, y_] = n1 + ((-1 + n1) ϵ (λ^2 - λ1^2) λ2^2)/(λ^2 (λ1^2 - λ2^2));
  gWsp = Plot[nn[x, 0], {x, -ro - 2 aa, ro + 2 aa}, PlotRange → {All, {0, 3}}];
  tlo = ContourPlot[nn[x, y], {x, -ro - 2 aa, ro + 2 aa},
    {y, -ro - 2 aa, ro + 2 aa}, Contours → 20, PlotPoints → 39];

  ν[x_, y_] = Log@(nn[x, y]);
  dνx[x_, y_] = D[ν[x, y], x];
  dνy[x_, y_] = D[ν[x, y], y];
  F[s_, x_, y_, ϕ_, t_] = {Cos[ϕ], Sin[ϕ],
     dνy[x, y] Cos[ϕ] - dνx[x, y] Sin[ϕ], Exp@(ν[x, y])} // Simplify;

  {s0, s1} = {0, ∞};
```

```
  {x0, y0, ϕ0, t0} = iniDat;

  hstart[] := Module[{f, df, fdf, Y0, x, y, ϕ, t, s, tmp},
    Y0 = Abs[{x0, y0, ϕ0}];
    f = Take[F[s0, x0, y0, ϕ0, t0], 3];
    df = Transpose[(D[Take[F[s, x, y, ϕ, t], 3], #] & /@ {x, y, ϕ}) /. s → s0 /.
          x → x0 /. y → y0 /. ϕ → ϕ0];
    fdf = Abs[f.df];
    tmp = Flatten@
      Table[If[fdf[[i]] > 0, Min[Sqrt[2 Y0[[i]] / fdf[[i]]], Abs[f[[i]]] / fdf[[i]]], ∞], {i, 1, 3}];
    Sqrt[δ] Min@tmp];
Clear[sol, tor];
  {δ = 10^-8, h = 1/10, hmax = h, nmax = 9000, ndone = 0,};
  FIO = F[s0, x0, y0, ϕ0, 0];
  sol = NestWhileList[KadaptRK3BS, {s0, x0, y0, ϕ0, t0},
    (2 ro ≥ Abs[#[[2]]] && ro + aa ≥ Abs[#[[3]]] && #[[1]] < s1 && ndone < nmax) &];
  Print["ndone= ", ndone];
  tor[tkolor_] :=
   ListPlot[{#[[2]], #[[3]]} & /@ sol, Joined → True, PlotStyle → tkolor];
  graf = Show[tor[kolor], PlotRange → All, AspectRatio → 1];
  Print[Show[{tlo, graf}]];
  graf]
```

Rysunek 7.20

```
gr75 = makeGraph[{-2, 0.1, π/180 75, 0}, 1, 650];
go75 = makeGraph[{-2, 0.1, π/180 75, 0}, 1, 615];
gy75 = makeGraph[{-2, 0.1, π/180 75, 0}, 1, 590];
gg75 = makeGraph[{-2, 0.1, π/180 75, 0}, 1, 510];
gb75 = makeGraph[{-2, 0.1, π/180 75, 0}, 1, 470];
gp75 = makeGraph[{-2, 0.1, π/180 75, 0}, 1, 410];
```

```
Show[{tlo, gr75, go75, gy75, gg75, gb75, gp75}]
```

Rysunek 7.21 przy nmax = 900

```
gr300 = makeGraph[{-2, 0.1, π/180 300, 0}, 1, 650];
gr315 = makeGraph[{-2, 0.1, π/180 300, 0}, 1, 650];
gr330 = makeGraph[{-2, 0.1, π/180 330, 0}, 1, 650];
gr0 = makeGraph[{-2, 0.1, π/180 0.1, 0}, 1, 650];
gr30 = makeGraph[{-2, 0.1, π/180 30, 0}, 1, 650];
gr45 = makeGraph[{-2, 0.1, π/180 45, 0}, 1, 650];
gr60 = makeGraph[{-2, 0.1, π/180 60, 0}, 1, 650];
gr90 = makeGraph[{-2, 0.1, π/180 89.9, 0}, 1, 650];
```

```
Show[{tlo, gr300, gr315, gr330, gr0, gr30, gr45, gr60, gr90}]
```