

## Flexirotation d'un tube souple / HEIG-VD / TIN / Mirko Croci

Cette technologie permet d'établir une connexion (électrique, pneumatique ou hydraulique) entre une pièce rotative et un châssis fixe.

L'extrémité mobile du tube est animée d'une vitesse de rotation équivalant au double de celle de l'anse.

## Implémentation

```

R = 1.0;
L = 0.5;
pi = N[π];

a[l_, 2] := Block[
  {A, C, D, F, G, al, AAP, be, CCp, ga, FFp, pi},
  A = {R, L};
  C = {R, 2 R + L};
  D = {2 R, 2 R + L};
  F = {R, 2 R + 2 L};
  G = {0, 2 R + 2 L};
  pi = N[π];
  Which[
    0 ≤ l && l < L,
    {0, 1},
    L ≤ l && l < L +  $\frac{R \pi}{2}$ ,
    al =  $\frac{l - L}{R}$ ; AAP = R {Cos[pi - al], Sin[pi - al]}; A + AAP,
    L +  $\frac{1}{2}$  R N[π] ≤ l && l < L + R pi,
    be =  $\frac{l - L}{R} - \frac{\pi}{2}$ ; CCp = R {Cos[be -  $\frac{\pi}{2}$ ], Sin[be -  $\frac{\pi}{2}$ ]};
    C + CCp, L + R pi ≤ l && l < 2 L + R pi,
    D + {0, 1 - (L + R pi)},
    2 L + R pi ≤ l && l < 2 L + 2 R pi,
    ga =  $\frac{l - 2 L}{R} - \pi$ ; FFp = R {Cos[ga], Sin[ga]}; F + FFp,
    2 L + 2 R pi ≤ l && l < 3 L + 2 R pi,
    G + {0, -(1 - (2 L + 2 R pi))}]
  ]
a[l_, 3] := Join[a[l, 2], {0}]
a[l_] := a[l, 3]

exy[l_] := Block[
  {al, be, ga, pi, x, y},
  pi = N[π];
  Which[0 ≤ l && l < L, {{1, 0}, {0, 1}},

```

```

L ≤ l && l < L +  $\frac{R \pi}{2}$ ,
a1 =  $\frac{l - L}{R}$ ; {{x = Cos[-a1], y = Sin[-a1]}, {y, -x}},
L +  $\frac{1}{2} R N[\pi] \leq l \&\& l < L + R \pi$ ,
be =  $\frac{l - L}{R} - \frac{\pi}{2}$ ; {{x = Cos[be -  $\frac{\pi}{2}$ ], y = Sin[be -  $\frac{\pi}{2}$ ]}, {y, -x}},
L + R π ≤ l && l < 2 L + R π, {{1, 0}, {0, 1}},
2 L + R π ≤ l && l < 2 L + 2 R π,
ga =  $\frac{l - 2 L}{R} - \pi$ ; {{x = Cos[ga], y = Sin[ga]}, {y, -x}},
2 L + 2 R π ≤ l && l ≤ 3 L + 2 R π,
{{-1, 0}, {0, -1}}]
]

exyz[l_] := Join[(Join[#1, {0}] &) /@exy[l], {{0, 0, 1}}]

Tran[{x0_?NumberQ, z0_?NumberQ}, l_] := a[l] + (x0 exyz[l][[1]] + {0, 0, z0})
Tran[s_, l_] := s /. p : {_?NumberQ, _?NumberQ} => Tran[p, l]

ctor2[w_] := {Re[w], Im[w]}
ctor2[l_List] := ctor2/@l

r2toc[{x_, z_}] := x + i z
Polygon2D[n_, r_, th_] := ctor2[Table[r e $\frac{(2 N[\pi]) i i}{n} + i th$ , {i, 0, n}]]

MakeTube[{a1_, a2_}, {b1_, b2_}] := {Polygon[{a1, b1, b2, a2}]}
MakeTube[{a1_, a2_, qa___}, {b1_, b2_, qb___}] := Join[MakeTube[{a1, a2}, {
MakeTube[{p1 : {__}, p2 : {__}]} := MakeTube[p1, p2]
MakeTube[{p1 : {__}, p2 : {__}, q : ({__} ...)}] := Join[MakeTube[p1, p2], Make

Ry[s_, th_] := Block[{m}, m = {{Cos[th], 0, -Sin[th]}, {0, 1, 0}, {Sin[th], 0, Cos[th]}}
```

## Exécution

```

ni = 80;
dang = 360.;
ang0 = 0.;
nseg = 20;
npoly = 6;
Do[
  Show[
    Graphics3D[
      MakeTube[Table[Ry[Tran[Polygon2D[npoly, 0.3,  $\frac{(2 \text{ pi}) (\text{ang0} + \frac{j \text{ dang}}{\text{ni}})}{360.}$ ], ns
      ],
      PlotRange -> {{-1.2 2 R, 1.2 x 2 R}, {0, 1.2 (3 R + 2 L)}, {-1.2 2 R, 1.2 x 2 R}
      {j, 0, ni - 1}
    ];

```

