

```
<!DOCTYPE html>
<html lang="zh">
<head>
<meta charset="UTF-8">
<title>圆轴扭转变形动画（增强版）</title>
<style>
body{
    margin:0;
    font-family:Arial;
    display:flex;
    flex-direction:column;
    height:100vh;
    background:#f5f5f5;
}

#top{
    flex:3;
    display:flex;
    justify-content:center;
    align-items:center;
    background:white;
}

canvas{
    background:white;
    border:1px solid #ccc;
}

#bottom{
    flex:1;
    padding:15px;
    background:#eee;
}

input[type=range]{
    width:400px;
}
</style>
</head>

<body>

<div id="top">
<canvas id="c" width="700" height="400"></canvas>
```

</div>

<div id="bottom">

<div>

扭矩 T: 50 N • m

</div>

<input type="range" min="0" max="100" value="50" id="slider">

<div style="margin-top:10px">

最大剪应力 τ max: 0

扭转角 Φ （可视化）: 0

</div>

</div>

<script>

const c = document.getElementById("c");

const ctx = c.getContext("2d");

const slider = document.getElementById("slider");

const Ttxt = document.getElementById("T");

const tautxt = document.getElementById("tau");

const phitxt = document.getElementById("phi");

const R = 80;

const L = 300;

const J = 1e6;

// 🖱️ 放大系数（让变形明显）

const deformScale = 0.8;

function draw(T){

ctx.clearRect(0,0,700,400);

const cx = 200;

const cy = 200;

// ===== 1. 扭转角（人为放大用于教学） =====

const phi = T * 0.02; // 可视化角度

const tauMax = T * R / J;

// ===== 2. 画“扭转圆柱网格” =====

for(let i=0;i<12;i++){

```

const x0 = cx - L/2;
const x1 = cx + L/2;

ctx.beginPath();

for(let x=x0;x<=x1;x+=10){

    const t = (x - x0)/L;

    const twist = phi * t;

    const yTop = cy - R;
    const yBottom = cy + R;

    const offsetX = Math.sin(twist) * R * deformScale;

    if(x===x0){
        ctx.moveTo(x + offsetX, yTop + i*(2*R/12));
    }else{
        ctx.lineTo(x + offsetX, yTop + i*(2*R/12));
    }
}

ctx.strokeStyle = "#444";
ctx.stroke();
}

```

// ===== 3. 画左右端面 =====

```

ctx.beginPath();
ctx.arc(cx - L/2, cy, R, 0, Math.PI*2);
ctx.stroke();

```

```

ctx.beginPath();
ctx.arc(cx + L/2, cy, R, 0, Math.PI*2);
ctx.stroke();

```

// ===== 4. 扭转箭头 =====

```

ctx.beginPath();
ctx.arc(cx + L/2, cy, 30, 0, phi);
ctx.strokeStyle="red";
ctx.stroke();

```

// ===== 5. 更新数值 =====

```
Ttxt.textContent = T;  
tautxt.textContent = tauMax.toFixed(6);  
phitxt.textContent = phi.toFixed(2) + " rad";  
}
```

```
// 初始化
```

```
draw(50);
```

```
slider.oninput = function(){  
    draw(Number(this.value));
```

```
}
```

```
</script>
```

```
</body>
```

```
</html>
```