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Joint Research of Optics and Fluid Interface

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Subject Index xxxx, xxx

1 Setup

Let Δ be the total width the light travels with path not being straight, hence:

$$\forall x \notin [-\frac{\Delta}{2}, \frac{\Delta}{2}] : \frac{d^2}{dx^2}y = 0 \tag{1}$$

Now define the light ray incoming from left-hand side towards right-hand side and (suppose transition layers' width approaches zero) refracs at origin. And let h be the thickness of the transition layers.

Now let's assume the incoming transition layer has the same thickness as outbounding transition layer, hence we get:

$$\Delta = \frac{h}{2}(\tan\theta_{in} + \tan\theta_{out}) \tag{2}$$

Now we can first confirm our path function is a function of $\theta_{in}, \theta_{out}, h$

$$P(\theta_{in}, \theta_{out}, h) = \tag{3}$$

2 Playing with Bezier Curve

First setup the environment

```
h, t=var("h t")
hh=h/2
theta, phi=var("theta phi")
assume(h, "constant")
assume(h>0)
assume(0<theta, theta<pi/2)
assume(0<phi, phi<pi/2)
```

And now we could try to solve functions like $y(x)$ from parametric bezier curve:

```
# x(t)=(t-1)^2*tan(theta)*hh*-1+t^2*tan(phi)*hh
y=(t-1)^2*hh-t^2*hh
```

First we try to find $t(x)$

```
result=[]
[((abs(res.rhs()(x=tan(theta)*hh*-1)(h=2, theta=0.2, phi=0.4))<1e-12 and abs(res.rhs()
t=result[0].rhs() if len(result)==1 else None
```

Where we get two solutions and only one will satisfied our assumptions (the first print is 0 and the second yields 1[1]), which is:

$$-\frac{h\tan(\theta)-\sqrt{h^2\tan(\phi)\tan(\theta)+2\left(h\tan(\phi)-h\tan(\theta)\right)x}}{h\tan(\phi)-h\tan(\theta)}$$

And substituting back to $y(t)$ we could get

$$\frac{1}{2}h\left(\frac{h\tan(\theta)-\sqrt{h^2\tan(\phi)\tan(\theta)+2\left(h\tan(\phi)-h\tan(\theta)\right)x}}{h\tan(\phi)-h\tan(\theta)}+1\right)^2-\frac{\left(h\tan(\theta)-\sqrt{h^2\tan(\phi)\tan(\theta)+2\left(h\tan(\phi)-h\tan(\theta)\right)x}\right)^2 h}{2\left(h\tan(\phi)-h\tan(\theta)\right)^2}$$

[1] Here we use $EPS = 1e-12$ as we're testing it with arbitrarily chosen values which makes them no longer symbolic.

3 Finding path

3.1 Constructing Layers

Let function $v(\theta_{in}, \theta_{out}, \Delta, \delta)$ be the velocity of layer δ (from the entry interface), whose entry velocity is θ_{in}, exit velocity is be θ_{out}, and the whole layer thickness is Δ.[2]

$$a = v(x, y, \beta - \alpha, \alpha) \tag{4a}$$

$$b = v(x, y, \beta - \alpha, \beta) \tag{4b}$$

$$\alpha \leq \beta \tag{4c}$$

Let $a = v(x, y, \alpha)$ and $b = v(x, y, \beta)$ $(\alpha \leq \beta)$, $\forall p \in [\alpha, \beta] : v(a, b, p - \alpha) = v(x, y, p)$

3.2 Fractal Structure

$$\text{Let } P(\theta_{in}, \theta_{out}, h) \text{ be the path taken} \tag{5}$$

$$P(\theta_{in \to \alpha}, \alpha) = P(\theta_{in}, \theta_\alpha \tag{6}$$

[2] Here we suppose every layer paraelles

4 Regarding Special Relativity

So first let the real velocity v, whom maintains the linear properties of traditional non-relativistic velocity.

Linear to non-linear (relativistic) velocity:

$$v_S = \frac{v_{\text{リ}}\, \text{エ}_S\, \text{リ}}{\text{エ}_S S} = v_{\text{リ}}\, \text{エ}_S\, \text{リ} \tag{7}$$

4.1 *Constant force/acceleration*

Let a point located at origin, with initial velocity $v(0) = 0$.

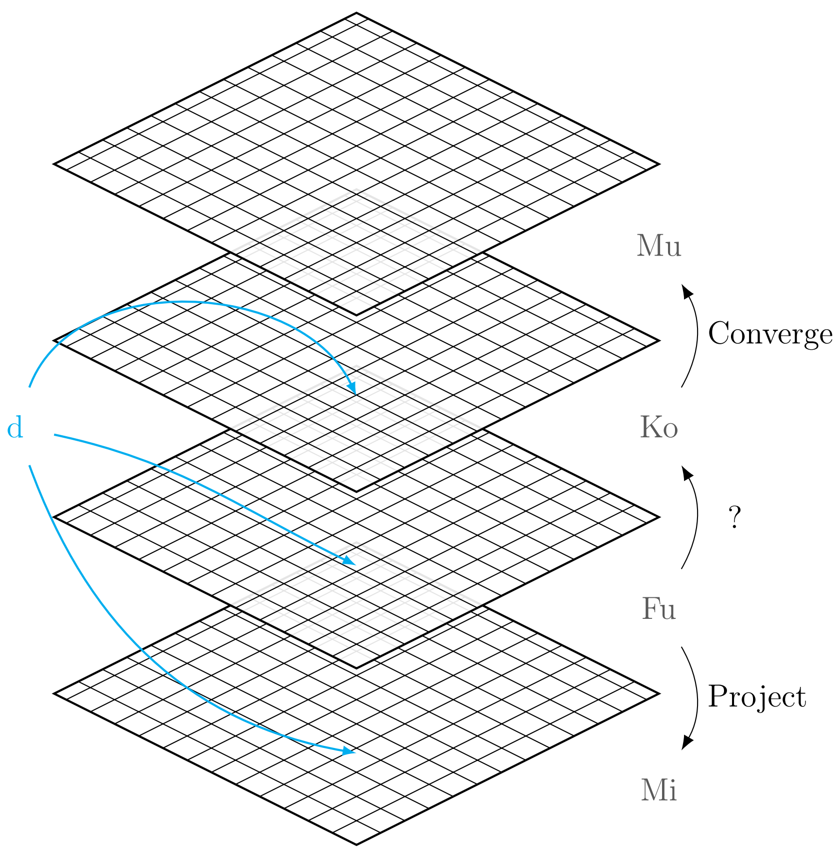
$$a_{\text{ヒ}}(v, F, m_{rest}) = \frac{F}{m_{rest}} \sqrt{1 - \frac{v^2}{c^2}}^3 \tag{8a}$$

$$a_{\text{リ}}(t) = k \tag{8b}$$

$$v_{\text{ヒ}}(t) = v_{\text{リ}}\, \text{エ}_S\, \text{リ} = kt\, \text{エ}_S\, \text{リ} \tag{8c}$$

$$v_{\text{ヒ}}(t) = \int \frac{F}{m_{rest}} \sqrt{1 - \frac{v_{\text{ヒ}}(t)^2}{c^2}}^3 \tag{8d}$$

5 Model of Particles



6 Conclusion

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Acknowledgment

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References

[1] https://www.mail-archive.com/dou-geometry@googlegroups.com/msg00004/____________-_____________
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