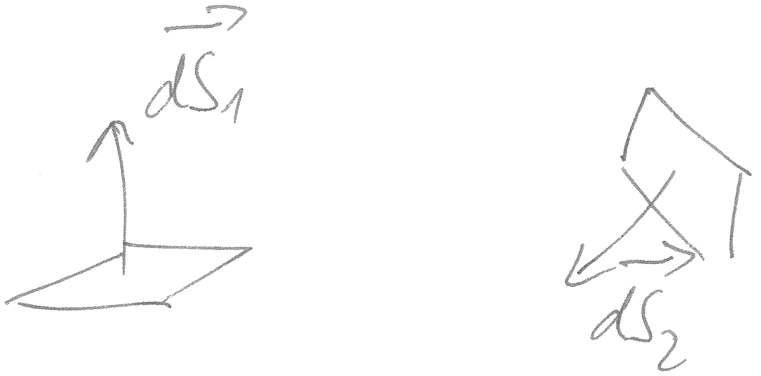


linearita vůči zakřivení plochy, je-li dost malá

$$d^2Q = M_{eon} \cdot \cos\alpha_1 \, dS \, d\Omega$$

co sálá kolmo

Lambertovský zářič

linearita vůči malému prostorovému úhlu v daném směru

do celého úhlu:

$$dQ = \int_{\Omega}^{\vartheta} M_{eon} \cos\alpha \cdot dS \, d\Omega =$$

$$= \int_{\varphi=0}^{2\pi} \int_{\vartheta=0}^{\pi/2} \cos\vartheta \sin\vartheta \, d\varphi \, d\vartheta \cdot M_{eon} =$$

$$= \pi \cdot dS \cdot M_{eon} \Rightarrow \boxed{M_{eon} = \frac{1}{\pi} \frac{dQ}{dS} = \frac{M_{eo}}{\pi}}$$

$$dQ_{dS_1 \to dS_2} = \frac{1}{\pi} M_{e0} \cdot \cos\alpha_1 \cdot dS_1 \cdot \frac{\cos\alpha_2 \, dS_2}{r^2}$$

$$dQ_{dS_1 \to \text{vše}} = M_{e0} \cdot dS$$

$$\varphi_{dS_1 \to dS_2} = \frac{dQ_{dS_1 \to dS_2}}{dQ_{dS_1 \to \text{vše}}} = \frac{1}{\pi} \frac{\cos\alpha_1 \cos\alpha_2}{r^2} dS_2$$

$$\varphi_{dS_1 \to S_2} = \frac{1}{\pi} \int_{S_2} \frac{\cos\alpha_1 \cos\alpha_2}{r^2} dS_2$$

$$\varphi_{S_1 \to S_2} = \frac{1}{S_1} \int_{S_1} \varphi_{dS_1 \to S_2} \, dS_1 = \frac{1}{S_1 \pi} \int_{S_1}\int_{S_2} \frac{\cos\alpha_1 \cos\alpha_2}{r^2} dS_1 dS_2$$

$1 \to 2; 2 \to 1 \Rightarrow \qquad S_1 \varphi_{S_1 \to S_2} = S_2 \varphi_{S_2 \to S_1}$

$$\begin{bmatrix} 1 - \varphi_{11}\rho_1 & -\rho_1\varphi_{12} \\ -\rho_2\varphi_{21} & 1 - \rho_2\varphi_{22} \end{bmatrix} \begin{bmatrix} w_1 \\ w_2 \end{bmatrix} = \begin{bmatrix} \varepsilon_1 \Pi_{eo1} \\ \varepsilon_2 \Pi_{eo2} \end{bmatrix}$$

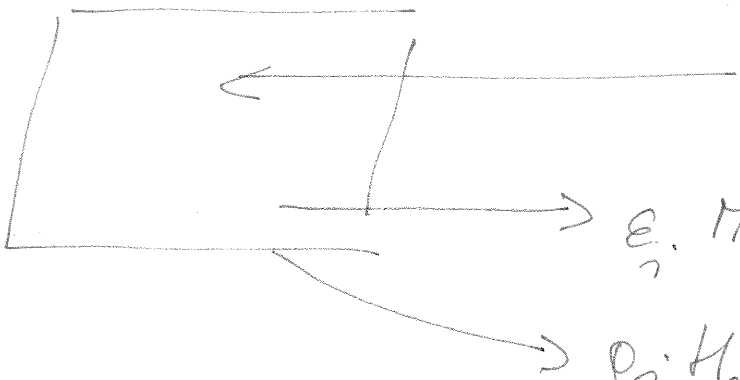
$$\begin{bmatrix} 1 \cancel{+} & , -(1-\varepsilon_1) \\ -(1-\varepsilon_2)\dfrac{s_1}{s_2} & , 1-(1-\varepsilon_2)\left(1-\dfrac{s_1}{s_2}\right) \end{bmatrix} \begin{bmatrix} w_1 \\ w_2 \end{bmatrix} = \begin{bmatrix} \varepsilon_1 \Pi_{eo1} \\ \varepsilon_2 \Pi_{eo2} \end{bmatrix}$$

Pokračování pohádky o sálání

- Zonální metoda

- 1) rozdělíme zkoumanou oblast na zóny, ve kterých můžeme považovat podstatné veličiny za konstantní

2) zde systémy, kde je sálání dominantní



$$H_i = \sum_{j=1}^{n} W_j \varphi_{ji}$$

„budicí toky"

$$\varepsilon_i M_{e0i}$$

$$\rho_i H_i$$

$$W_i = \varepsilon_i M_{e0i} + \rho_i \sum_{j=1}^{n} W_j \varphi_{ji}$$

upravme:

$$\cancel{W_i - \rho_i \sum_{j=1}^{N} W_j \varphi_{ij}}$$

$\rho_i = 1 - \varepsilon_i$ (neprůteplivá tělesa)

Pro celkový výkon přijatý i-tou plochou ale platí:

$$H_i S_i = \sum_{j=1}^{N} W_j S_j \varphi_{ji} \quad / : S_i$$

$$H_i = \sum_{j=1}^{N} W_j \underbrace{\frac{S_j}{S_i} \varphi_{ji}}_{\varphi_{ij}} = \sum_{j=1}^{N} W_j \varphi_{ij}$$

$$W_i - \rho_i \sum_{j=1}^{N} W_j \varphi_{ij} = \varepsilon_i M_{eoi}$$

$$\begin{bmatrix} 1-\varphi_{11}\rho_1, & -\rho_1\varphi_{12}, & -\rho_1\varphi_{13} & \cdots \\ -\rho_2\varphi_{21}, & 1-\rho_2\varphi_{22}, & -\rho_2\varphi_{23} & \cdots \\ \vdots & & & \\ \vdots & & & \end{bmatrix} \begin{bmatrix} W_1 \\ W_2 \\ \vdots \\ W_n \end{bmatrix} = \begin{bmatrix} \varepsilon_1 M_{eo1} \\ \varepsilon_2 M_{eo2} \\ \vdots \\ \varepsilon_n M_{eon} \end{bmatrix}$$

Q vyzář. $= W_i - H_i = \varepsilon_i M_{eoi} + \rho_i H_i - H_i =$

$$= W_i - \frac{W_i - \varepsilon_i M_{eo}}{\rho_i} = \frac{W_i \rho_i - W_i + \varepsilon_i M_{eo}}{\rho_i} =$$

$$= \frac{-W_i \overbrace{(1-\rho_i)}^{\varepsilon_i} + \varepsilon_i M_{eo}}{\rho_i} = \frac{M_{eo}\varepsilon_i - W_i \varepsilon_i}{\rho_i} =$$

$$= \frac{\varepsilon_i}{\rho_i}\left(M_{eo} - W_i\right)$$

Př. 1 těleso je uvnitř druhého:

$$\varphi_{12} = 1$$

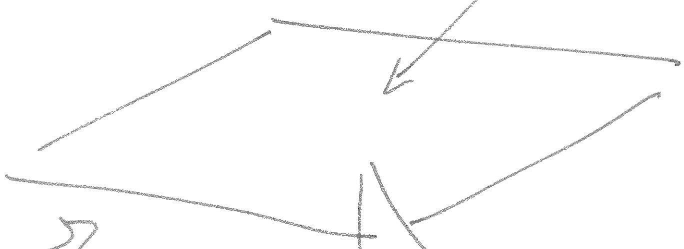
a nesálá na sebe: $\varphi_{11} = 0$

podle definice: $S_2 \varphi_{21} = S_1 \varphi_{12} = S_1$

$$\Rightarrow \varphi_{21} = \frac{S_1}{S_2}$$

$$\varphi_{22} = 1 - \frac{S_1}{S_2}$$

$$H_i \cdot S_i = \sum_j W_j \, S_j \, \varphi_{ji}$$



i-tá plocha

$$\left.\begin{array}{l} S_i \cdot \varepsilon_i \cdot M_{eoi} \\ \\ S_i \cdot \rho_i \cdot H_i \end{array}\right\} W_i \cdot S_i$$

$$H_i = \frac{W_i - \varepsilon_i M_{eoi}}{\rho_i}$$

$$H_i = \sum_j W_j \frac{S_j}{S_i} \varphi_{ji} = \sum_j W_j \, \varphi_{ij}$$

$$W_i - \varepsilon_i M_{eoi} = \rho_i \sum_j W_j \, \varphi_{ij}$$

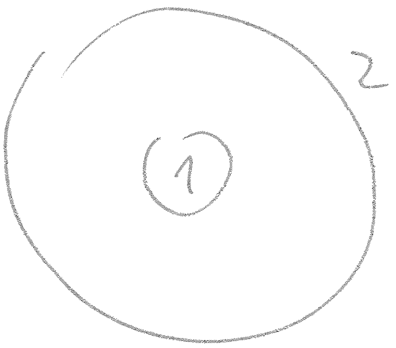
rovnice pro W_i, resp.

$$W_i - \rho_i \sum_j W_j \, \varphi_{ij} = \varepsilon_i \, M_{eoi}$$

$$q_{výsl} = W_i - H_i = W_i - \frac{W_i - \varepsilon_i \cdot M_{eo\,i}}{\rho_i} =$$

$$= \frac{-W_i \overbrace{(1-\rho_i)}^{\varepsilon_i} + \varepsilon_i \cdot M_{eo\,i}}{\rho_i} = \frac{\varepsilon_i}{\rho_i}\left(M_{eo} - W_i\right)$$

Př: 1 těleso uvnitř druhého:



$$\varphi_{12} = 1$$

$$\varphi_{11} = 0$$

$$S_2 \varphi_{21} = S_1 \varphi_{12} = S_1$$

$$\varphi_{21} = \frac{S_1}{S_2} \quad ; \quad \varphi_{22} = 1 - \frac{S_1}{S_2}$$

+ přiložený přehled:

```
In[11]:= mat = {{1 - φ11 * ρ1, -ρ1 * φ12}, {-ρ2 * φ21, 1 - ρ2 * φ22}};
         vect = {ϵ1 * M01, ϵ2 * M02};
         res = Simplify[LinearSolve[mat, vect]]
```

$$\text{Out[13]}= \left\{\frac{-M02\,\epsilon2\,\rho1\,\varphi12 + M01\,\epsilon1\,(-1+\rho2\,\varphi22)}{-1+\rho2\,\varphi22+\rho1\,(\varphi11+\rho2\,\varphi12\,\varphi21-\rho2\,\varphi11\,\varphi22)},\ \frac{M02\,(\epsilon2-\epsilon2\,\rho1\,\varphi11)+M01\,\epsilon1\,\rho2\,\varphi21}{1-\rho2\,\varphi22-\rho1\,(\varphi11+\rho2\,\varphi12\,\varphi21-\rho2\,\varphi11\,\varphi22)}\right\}$$

$$\text{In[24]:=}\ \text{dosad} = \left\{\rho1 \to (1-\epsilon1),\ \rho2 \to (1-\epsilon2),\ \varphi12 \to 1,\ \varphi11 \to 0,\ \varphi21 \to \frac{S1}{S2},\ \varphi22 \to 1-\frac{S1}{S2}\right\};$$

```
         novres = Simplify[res /. dosad]
         W1 = novres[[1]];
```

$$\text{Out[25]}= \left\{\frac{M02\,S2\,(-1+\epsilon1)\,\epsilon2 + M01\,\epsilon1\,(S1\,(-1+\epsilon2) - S2\,\epsilon2)}{S1\,\epsilon1\,(-1+\epsilon2) - S2\,\epsilon2},\ \frac{M01\,S1\,\epsilon1\,(-1+\epsilon2) - M02\,S2\,\epsilon2}{S1\,\epsilon1\,(-1+\epsilon2) - S2\,\epsilon2}\right\}$$

$$\text{In[33]:=}\ H1 = \text{Simplify}\left[\frac{W1 - \epsilon1 * M01}{\rho1}\ /.\ \text{dosad}\right]$$

```
         qvysl = Simplify[W1 - H1]
```

$$\text{Out[33]}= \frac{M01\,S1\,\epsilon1\,(-1+\epsilon2) - M02\,S2\,\epsilon2}{S1\,\epsilon1\,(-1+\epsilon2) - S2\,\epsilon2}$$

$$\text{Out[34]}= \frac{(M01 - M02)\,S2\,\epsilon1\,\epsilon2}{S2\,\epsilon2 + S1\,(\epsilon1 - \epsilon1\,\epsilon2)}$$

```
In[137]:= mat = {{1 - φ11 * ρ1, -ρ1 * φ12}, {-ρ2 * φ21, 1 - ρ2 * φ22}};
          vect = {ϵ1 * M01, ϵ2 * M02};
          res = Simplify[LinearSolve[mat, vect]]
```

```
General::spell1 : Possible spelling error: new symbol name "φ21" is similar to existing symbol "φ12".

General::spell1 : Possible spelling error: new symbol name "ϵ1" is similar to existing symbol "ρ1".

General::spell1 : Possible spelling error: new symbol name "ϵ2" is similar to existing symbol "ρ2".
```

Out[139]=
$$\left\{\frac{-\text{M02}\,\epsilon 2\,\rho 1\,\varphi 12+\text{M01}\,\epsilon 1\,(-1+\rho 2\,\varphi 22)}{-1+\rho 2\,\varphi 22+\rho 1\,(\varphi 11+\rho 2\,\varphi 12\,\varphi 21-\rho 2\,\varphi 11\,\varphi 22)},\ \frac{\text{M02}\,(\epsilon 2-\epsilon 2\,\rho 1\,\varphi 11)+\text{M01}\,\epsilon 1\,\rho 2\,\varphi 21}{1-\rho 2\,\varphi 22-\rho 1\,(\varphi 11+\rho 2\,\varphi 12\,\varphi 21-\rho 2\,\varphi 11\,\varphi 22)}\right\}$$

In[140]:=
$$\text{dosad}=\left\{\rho 1\to(1-\epsilon 1),\ \rho 2\to(1-\epsilon 2),\ \varphi 12\to 1,\ \varphi 11\to 0,\ \varphi 21\ \text{->}\ \frac{\text{S1}}{\text{S2}},\ \varphi 22\to 1-\frac{\text{S1}}{\text{S2}}\right\};$$

```
          novres = Simplify[res /. dosad]
          W1 = novres[[1]];
```

Out[141]=
$$\left\{\frac{\text{M02 S2}\,(-1+\epsilon 1)\,\epsilon 2+\text{M01}\,\epsilon 1\,(\text{S1}\,(-1+\epsilon 2)-\text{S2}\,\epsilon 2)}{\text{S1}\,\epsilon 1\,(-1+\epsilon 2)-\text{S2}\,\epsilon 2},\ \frac{\text{M01 S1}\,\epsilon 1\,(-1+\epsilon 2)-\text{M02 S2}\,\epsilon 2}{\text{S1}\,\epsilon 1\,(-1+\epsilon 2)-\text{S2}\,\epsilon 2}\right\}$$

In[143]:=
$$\text{H1}=\text{Simplify}\left[\frac{\text{W1}-\epsilon 1*\text{M01}}{\rho 1}\ /.\ \text{dosad}\right]$$

```
          qvysl = Simplify[W1 - H1]
```

Out[143]=
$$\frac{\text{M01 S1}\,\epsilon 1\,(-1+\epsilon 2)-\text{M02 S2}\,\epsilon 2}{\text{S1}\,\epsilon 1\,(-1+\epsilon 2)-\text{S2}\,\epsilon 2}$$

Out[144]=
$$\frac{(\text{M01}-\text{M02})\,\text{S2}\,\epsilon 1\,\epsilon 2}{\text{S2}\,\epsilon 2+\text{S1}\,(\epsilon 1-\epsilon 1\,\epsilon 2)}$$

In[149]:=
$$\text{vyr}=\text{FullSimplify}[\text{qvysl}\ /.\ \{\text{M01}\to\sigma*\text{T1}^4,\ \text{M02}\to\sigma*\text{T2}^4\}]$$

Out[149]=
$$\frac{\text{S2}\,(\text{T1}^4-\text{T2}^4)\,\epsilon 1\,\epsilon 2\,\sigma}{\text{S2}\,\epsilon 2+\text{S1}\,(\epsilon 1-\epsilon 1\,\epsilon 2)}$$

In[159]:=
$$\frac{\text{Numerator}[\text{vyr}]}{\epsilon 1\,\epsilon 2*\text{S2}}$$

Out[159]=
$$(\text{T1}^4-\text{T2}^4)\,\sigma$$

In[158]:=
$$\text{Expand}\left[\frac{\text{Denominator}[\text{vyr}]}{\epsilon 1\,\epsilon 2*\text{S2}}\right]$$

Out[158]=
$$-\frac{\text{S1}}{\text{S2}}+\frac{1}{\epsilon 1}+\frac{\text{S1}}{\text{S2}\,\epsilon 2}$$