1)

• Broj nezavisnih matematičkih modela

$$r=O+D-1=3+1-1=3$$

O - broj zatvorenih poligona koji su medjusobno nezavisni (u sebi sadrže bar jednu visinsku

 razliku koja nije sadržana u drugim poligonima)

 D - broj datih tacaka.

• Uslovne jednačine

$$\hat{h}\_{1}+\hat{h}\_{6}-\hat{h}\_{4}=0$$

$$\hat{h}\_{2}+\hat{h}\_{3}-\hat{h}\_{6}=0$$

$$\hat{h}\_{1}+\hat{h}\_{2}-\hat{h}\_{5}=0$$

$ v\_{1}+v\_{6}-v\_{4}+ω\_{1}=0$ , $ ω\_{1}=h\_{1}+h\_{6}-h\_{4}$

$$v\_{2}+v\_{3}-v\_{6}+ω\_{2}=0 , ω\_{2}=h\_{2}+h\_{3}-h\_{6}$$

$$ v\_{1}+v\_{2}-v\_{5}+ω\_{3}=0 , ω\_{3}=h\_{1}+h\_{2}-h\_{5}$$

• Matrica dizajna $A$ i vektor slobodnih članova $ω$

|  |  |  |  |
| --- | --- | --- | --- |
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|  |  |  |  |
|  |  |  |  |
|  $A=$ |  |  |  |
|  |  |  |  |
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|  |  |
| --- | --- |
|  |  |
|  $ω=$ |  |
|  |  |

• Homogenizacija težina

$$P\_{i}=\frac{1}{S\_{i}}$$

$P\_{1}=\frac{1}{S\_{1}}=[\frac{1}{km}]$ *,* $P\_{2}=\frac{1}{S\_{2}}=[\frac{1}{km}]$ *,* $P\_{3}=\frac{1}{S\_{3}}=[\frac{1}{km}]$

$P\_{4}=\frac{1}{S\_{4}}=[\frac{1}{km}]$ *,* $P\_{5}=\frac{1}{S\_{5}}=[\frac{1}{km}]$ *,* $P\_{6}=\frac{1}{S\_{6}}=[\frac{1}{km}]$

• Matrica težina $P$

$$P\_{diag}=[ ]$$

• Matrica koeficijenata normalnih jednačina $N$ i vektor korelata $k$

 $ N=A^{T}∙P∙ A$ $k=N^{-1}∙ω$

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| --- | --- | --- | --- |
|  |  |  |  |
| $N=$ |  |  |  |
|  |  |  |  |

|  |  |
| --- | --- |
|  |  |
|  $k=$ |  |
|  |  |

• Vektor popravaka merenih veličina $\hat{V}$

$$\hat{V}=P^{-1}∙A∙k$$

|  |  |
| --- | --- |
|  | $$mm$$ |
|  | $$mm$$ |
|  | $$mm$$ |
| $$ \hat{V}=$$ | $$mm$$ |
|  | $$mm$$ |
|  | $$mm$$ |

• Kontrola izravnanja

 $V^{T}∙P∙V=$ $-k^{T}∙ω=$

• Izravnate vrednosti merenih veličina $\hat{l}\_{i}$

$$\hat{l}\_{i}=l\_{i}+v\_{i}$$

 $\hat{h}\_{1}=h\_{1}+v\_{1}= m$ $\hat{h}\_{4}=h\_{4}+v\_{4}= m$

 $\hat{h}\_{2}=h\_{2}+v\_{2}= m$ $\hat{h}\_{5}=h\_{5}+v\_{5}=m$

 $\hat{h}\_{3}=h\_{3}+v\_{3}= m$ $\hat{h}\_{6}=h\_{6}+v\_{6}= m$

• Ocena tačnosti

$$S\_{0}=\sqrt{\frac{V^{T}∙P∙V}{r}}=$$

• Definitivna kontrola izravnanja

$$\hat{h}\_{1}+\hat{h}\_{6}-\hat{h}\_{4}=0 $$

$$\hat{h}\_{2}+\hat{h}\_{3}-\hat{h}\_{6}=0$$

$$\hat{h}\_{1}+\hat{h}\_{2}-\hat{h}\_{5}=0$$

2)

• Približne visine repera$ H\_{A}$ i $H\_{B}$

$ X\_{0,1}=H\_{A}=H\_{1}+h\_{1}$ *,* $X\_{0,2}=H\_{A}=H\_{2}+h\_{2}$ *,* $X\_{0}=\frac{X\_{0,1}+X\_{0,2}}{2}= m$

$Y\_{0,1}=H\_{B}=H\_{3}+h\_{5}$ *,* $Y\_{0,2}=H\_{B}=H\_{4}-h\_{6}$ *,* $Y\_{0}=\frac{Y\_{0,1}+Y\_{0,2}}{2}= m$

• Uslovne jednačine

$$H\_{1}+h\_{1}+v\_{1}=X\_{0}+ΔX$$

$$H\_{2}+h\_{2}+v\_{2}=X\_{0}+ΔX$$

$$X\_{0}+ΔX+h\_{3}+v\_{3}=Y\_{0}+ΔY$$

$$H\_{2}+h\_{4}+v\_{4}=Y\_{0}+ΔY$$

$$H\_{3}+h\_{5}+v\_{5}=Y\_{0}+ΔY$$

$$Y\_{0}+ΔY+h\_{6}+v\_{6}=H\_{4}$$

$$v\_{1}- ΔX+ω\_{1}=0 ω\_{1}=H\_{1}+h\_{1}-X\_{0}$$

$$ v\_{2}- ΔX+ ω\_{2}=0 ω\_{2}=H\_{2}+h\_{2}-X\_{0}$$

$$ v\_{3}+ΔX-ΔY+ω\_{3}=0 ω\_{3}=X\_{0}+h\_{3}-Y\_{0} $$

$ v\_{4}-ΔY+ω\_{4}=0$$ω\_{4}=H\_{2}+h\_{4}-Y\_{0}$

$ v\_{5}-ΔY+ω\_{5}=0$$ ω\_{5}=H\_{3}+h\_{5}-Y\_{0}$

$ v\_{6}+ΔY+ω\_{6}=0$$ ω\_{6}=Y\_{0}+ h\_{6}-H\_{4}$

$$A^{T}∙V+B∙\hat{x}+ω=0$$

• Matrica dizajna $A$ i vektor slobodnih članova $ω$

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|  |  |  |  |  |  |  |
|  $A=$ |  |  |  |  |  |  |
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| --- | --- |
|  |  |
|  |  |
|  |  |
|  $ω=$ |  |
|  |  |
|  |  |

• Matrica nepoznatih parametara $B$

|  |  |  |
| --- | --- | --- |
|  |  $X\_{0}$ |  $Y\_{0}$ |
|  |  |  |
|  |  |  |
|  |  |  |
|  $B=$ |  |  |
|  |  |  |
|  |  |  |

• Homogenizacija težina

$$P\_{i}=\frac{1}{S\_{i}}$$

$P\_{1}=\frac{1}{S\_{1}}=[\frac{1}{km}]$ *,* $P\_{2}=\frac{1}{S\_{2}}=[\frac{1}{km}]$ *,* $P\_{3}=\frac{1}{S\_{3}}=[\frac{1}{km}]$

$P\_{4}=\frac{1}{S\_{4}}=[\frac{1}{km}]$ *,* $P\_{5}=\frac{1}{S\_{5}}=[\frac{1}{km}]$ *,* $P\_{6}=\frac{1}{S\_{6}}=[\frac{1}{km}]$

• Matrica težina $P$

$$P\_{diag}=[ ]$$

• Matrica koeficijenata normalnih jednacina $N$ i vektor korelata $k$

 $ N=A^{T}∙P^{-1}∙ A$ , $k=[N^{-1}∙B∙\left(B^{T}∙N^{-1}∙B)^{-1}∙B^{T}∙N^{-1}-N^{-1}\right]∙ω$

|  |
| --- |
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|  $N=$ |
|  |
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| --- | --- |
|  |  |
|  |  |
|  |  |
| $$ k=$$ |  |
|  |  |
|  |  |

• Vektor nepoznatih parametara $\hat{x}$

$$\hat{x}=-(B^{T}∙N^{-1}∙B)^{-1}∙B^{T}∙N^{-1}∙ω$$

|  |  |
| --- | --- |
|  | $$mm$$ |
| $$\hat{x}=$$ | $$mm$$ |

• Vektor popravaka merenih veličina $\hat{V}$

$$\hat{V}=P^{-1}∙A∙k$$

|  |  |
| --- | --- |
|  | $$mm$$ |
|  | $$mm$$ |
|  $\hat{V}=$ | $$mm$$ |
|   | $$mm$$ |
|  | $$mm$$ |
|  | $$mm$$ |

• Kontrola izravnanja

 $V^{T}∙P∙V=$ $-ω^{T}∙k=$

• Izravnate vrednosti merenih veličina i nepoznatih parametara

$ \hat{h}\_{1}=h\_{1}+v\_{1}$=$ m$

 $\hat{h}\_{2}$ $=h\_{2}+v\_{2}$=$ m$

$ \hat{h}\_{3}=h\_{3}+v\_{3}$=$ m$

$ \hat{h}\_{4}=h\_{4}+v\_{4}$=$ m$

$ \hat{h}\_{5}=h\_{5}+v\_{5}$=$ m$

$ \hat{h}\_{6}=h\_{6}+v\_{6}$=$ m$

 $ X\_{0,1}=H\_{A}=H\_{1}+\hat{h}\_{1}$ *,* $X\_{0,2}=H\_{A}=H\_{2}+\hat{h}\_{2}$ *,* $X\_{0}=\frac{X\_{0,1}+X\_{0,2}}{2}= m$

$Y\_{0,1}=H\_{B}=H\_{3}+\hat{h}\_{5}$ *,* $Y\_{0,2}=H\_{B}=H\_{4}-\hat{h}\_{6}$ *,* $Y\_{0}=\frac{Y\_{0,1}+Y\_{0,2}}{2}= m$

• Definitivna kontrola izravnanja

$$\hat{h}\_{1}-\hat{h}\_{2}-\left(H\_{2}-H\_{1}\right)=0$$

 $\hat{h}\_{2}+\hat{h}\_{3}-\hat{h}\_{4}=0$

 $\hat{h}\_{5}+\hat{h}\_{6}-\left(H\_{4}-H\_{3}\right)=0$

 $\hat{h}\_{4}-\hat{h}\_{5}-\left(H\_{2}-H\_{3}\right)=0$

• Ocena tačnosti

$$S\_{0}=\sqrt{\frac{V^{T}∙P∙V}{r-u}} S\_{0}=\sqrt{\frac{}{}}=$$