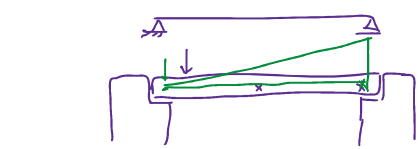
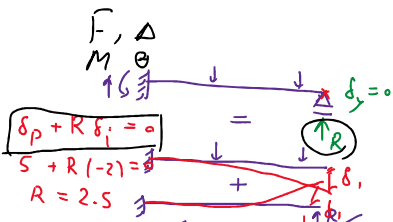
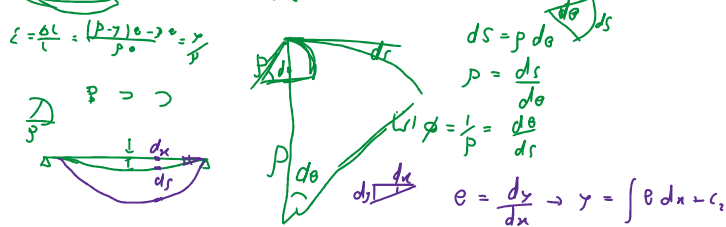
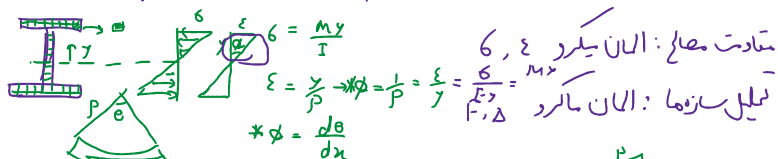
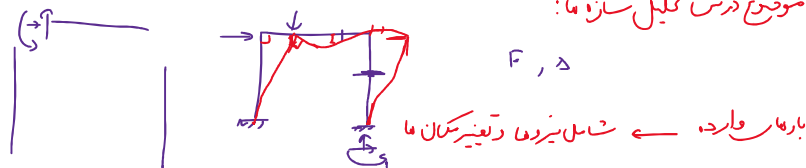


سرمحل درسی

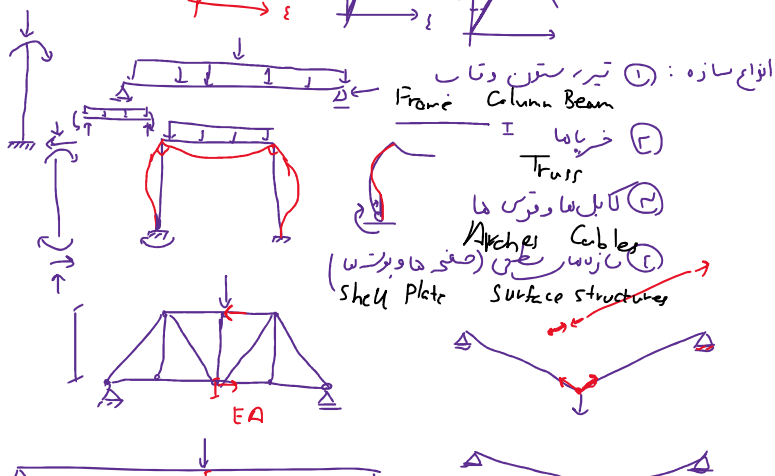
- ① پایداری و معین سازه ما
- ② تحلیل سازه های معین استاتیکی
- ③ محاسب تغییر شکل های سازه بر روش های انرژی سطح، بارالاینگ و تیر مزدوج
- ④ محاسب تغییر شکل ها بر روش های انرژی شامل کاربرد مجاز و بار واحد، قضایای هاستیلیانو و قضایای وینکلسن
- ⑤ تحلیل سازه های نامعین بر روش نریوی (نرو): روش سگتاری تغییر شکل ما
- ⑥ خط تأثیر سازه های معین

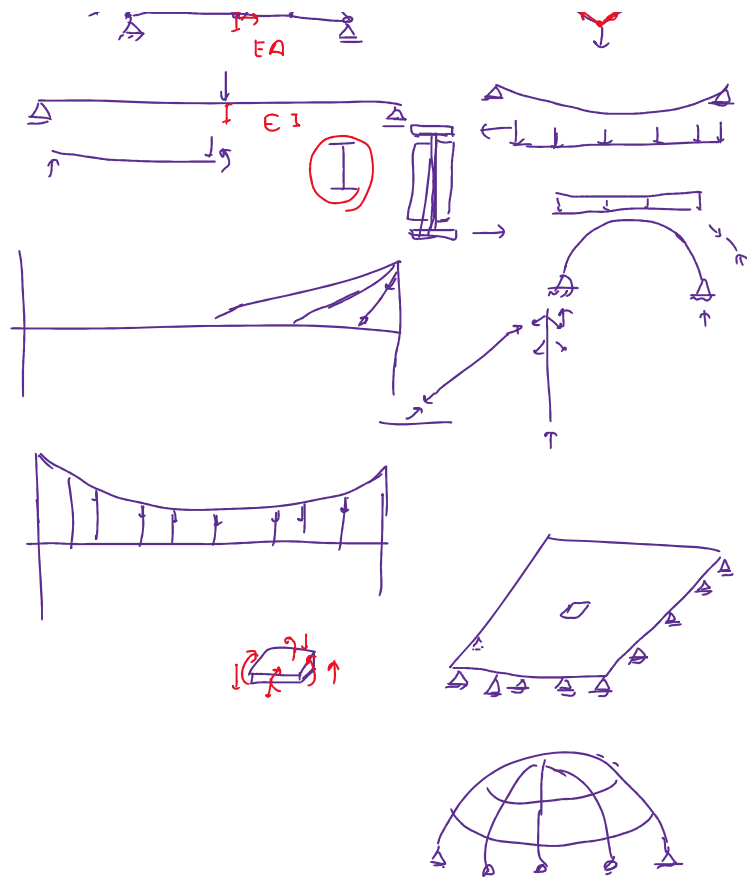


موضوع درسی تحلیل سازه ما:

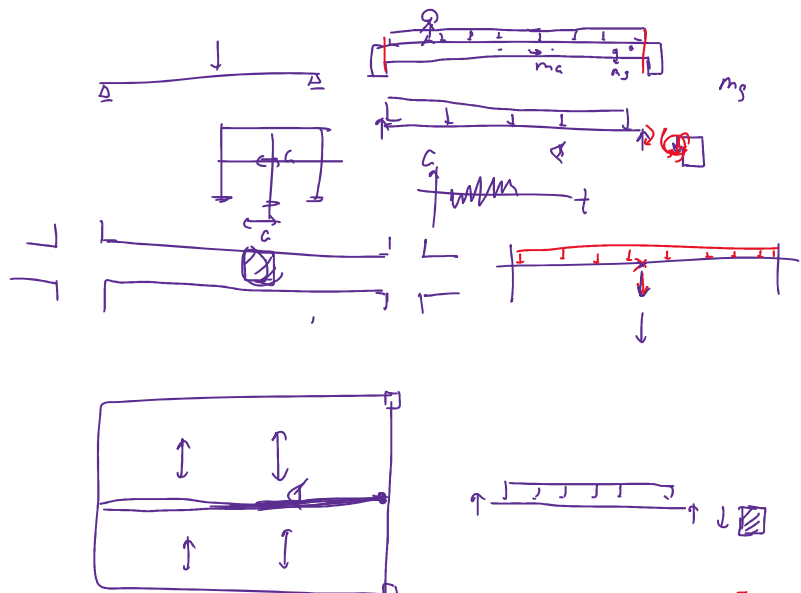


$$\phi = \frac{\theta}{\gamma} = \frac{\epsilon}{E \gamma} = \frac{M y}{E I \gamma} = \frac{M}{E I} \rightarrow \frac{d\theta}{dx} = \frac{M}{E I} \rightarrow \theta = \int \frac{M}{E I} dx + C_1$$



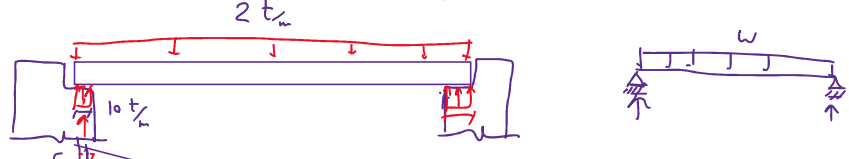


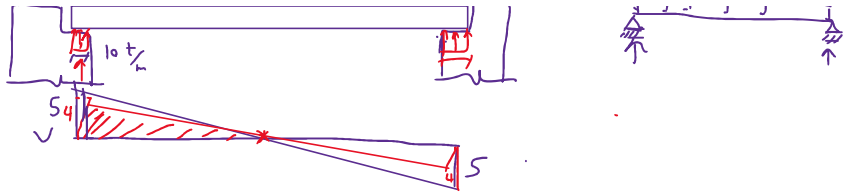
بار بدنه } بار استاتیکی } بار پویا } بار استاتیکی } بار پویا }
 بار تماس } بار استاتیکی } بار پویا } بار استاتیکی } بار پویا }



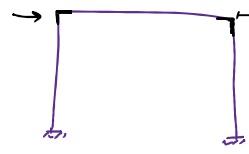
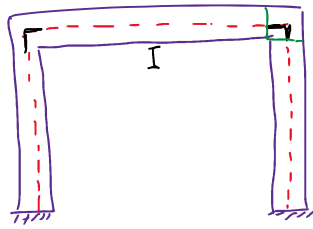
فرضیات:

① فرض برسا و استواری و عکس العمل تکیه گاه استواری





(۲) امکان بار را به صورت خط Centerline



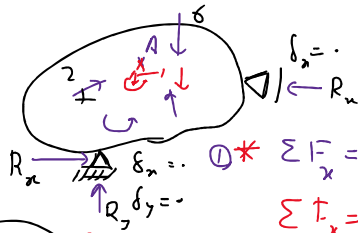
(۳) رفتار خط مصالح $\sigma = E\varepsilon$ $\frac{1}{\rho} = \frac{M}{EI}$

(۴) صرف تغییر شکل (موض تغییر شکل دارد)

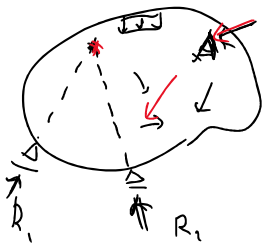


فصل اول:

باید ارس و معین سازه ما

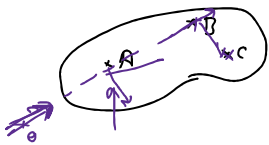


$\sum F_x = 0$ $\sum F_y = 0$ $\sum M_A = 0$
 $\sum F_x = m a_x$ $\sum F_y = m a_y$ $\sum M = I \alpha$



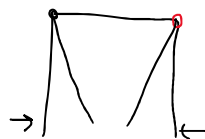
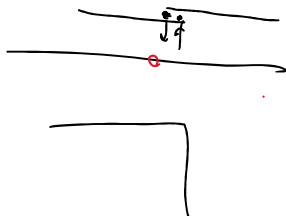
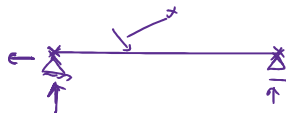
(۲) $\sum M_A = 0$ $\sum M_B = 0$ $\sum F_y = 0$

بر شرط که محور معادله نیز در امتداد AB نمودن است.



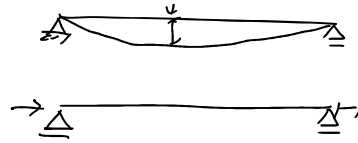
(۳) $\sum M_A = 0$ $\sum M_B = 0$ $\sum M_C = 0$

بر شرط که A, B, C در یک امتداد باشند.



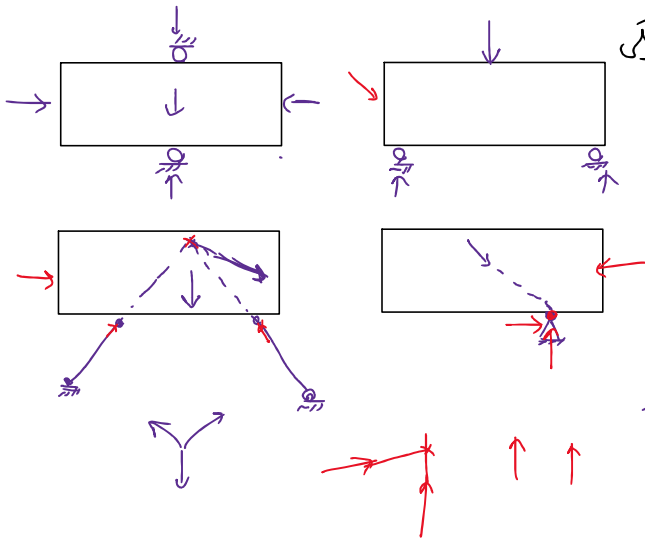
{ Rigid body motion حرکت
 deformation تغییر شکل





بایداری و معین یک جسم صلب

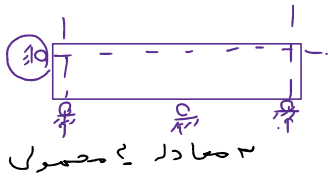
① لازم ہے معمول ناایداری اتالی
ملنے لگے ہ



تبادل بایداری

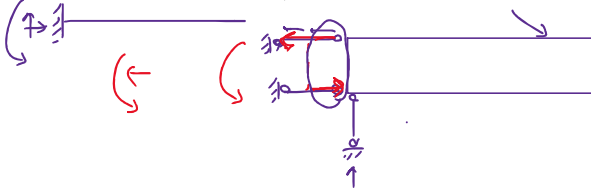


② معمول لگے گاں

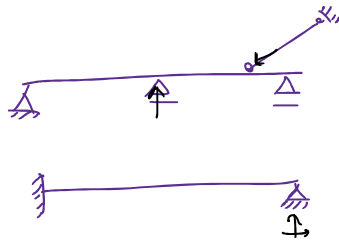


۳ معادلہ ہے معمولی

بایداری و معین



③ ایسی لڑ ہے معمول لگے گاں



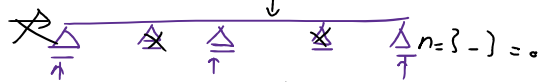
$$5 - 3 = 2$$

2

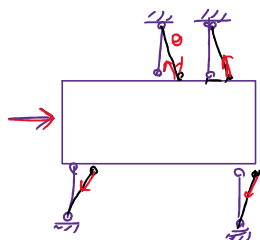
بایداری نا معین

④ یہ معمول لگے گاں لازمات ولی کافی نیست

ناایداری ہنس خارجی

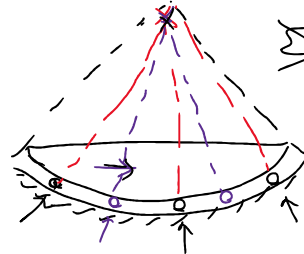


$$\sum R = 0$$



ناایداری ہنس (آئن)

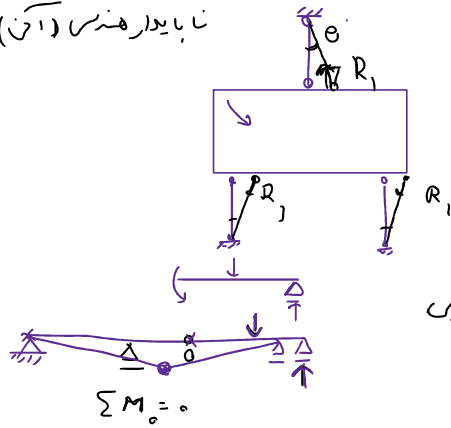
$$N = 3 - 3 = 0$$



ناایداری ہنس

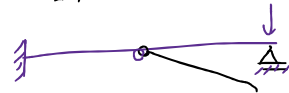
سایدارهنگی

سایدارهنگی (آهن)

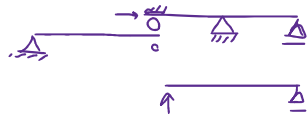


سایدار در صغیر سازه

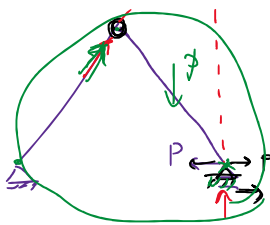
سایدارات تکی



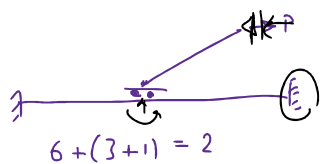
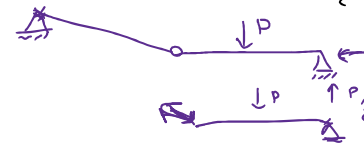
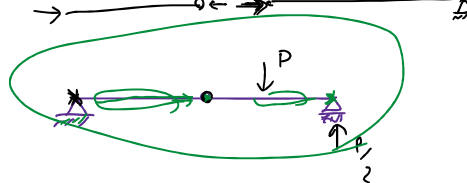
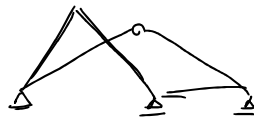
$4 - (3 + 1) = 0$



$\Sigma M_0 = 0$
 $\Sigma F_x = 0$



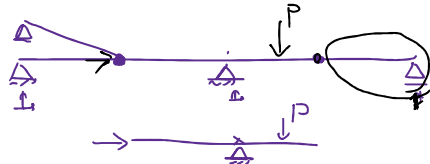
سایدارهنگی داخلی



$6 + (3 + 1) = 2$



$n = 7 - (3 + 4) = 0$



$n = 5 - (3 + 2) = 0$

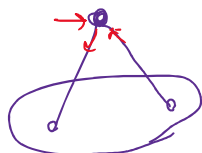
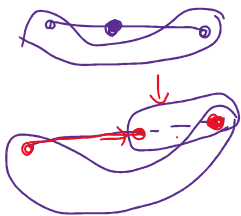
ترکیب سایدار اجسام صلب

① ترکیب یک جسم صلب بیک مفصل

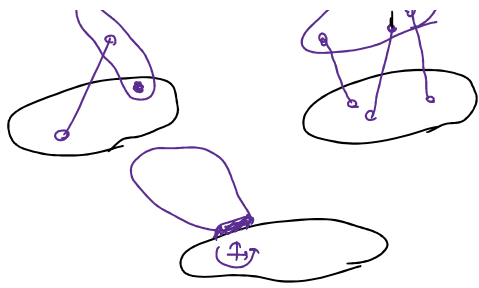
$\begin{cases} \Sigma F_x = 0 \\ \Sigma F_y = 0 \end{cases}$

حداقل ۲ مجهول →
(۲ میل)

② ترکیب سایدار دو جسم صلب



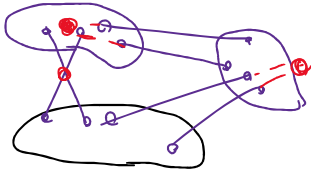
$\Sigma F_x = 0$



⑤ ترکیب بایدار دو جسم صلب

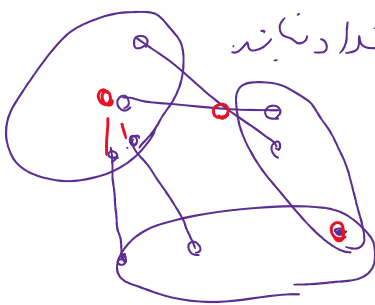
$$\begin{cases} \sum F_x = 0 \\ \sum F_y = 0 \rightarrow \text{حلایل بی محبول} \\ \sum M = 0 \end{cases}$$

⑥ ترکیب بایدار سه جسم صلب

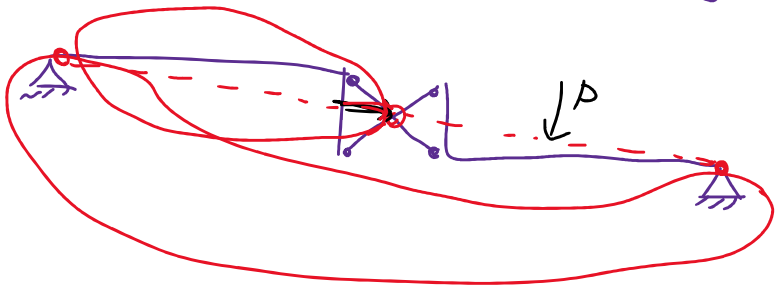
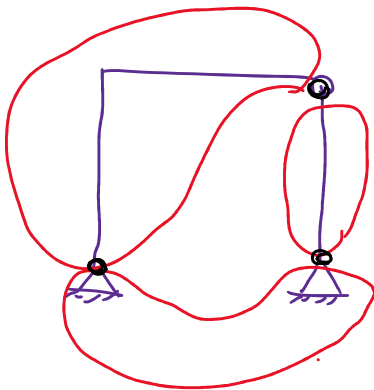
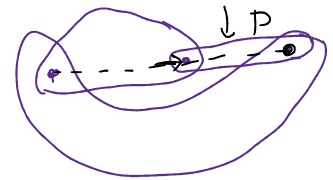


⑦ محبول ۴ معادله
⑧ مفضل نه درت استوار نباشند

⑨ میده نه سرد جسم صلب با میده وصل شود و
مناصل برهوس درت استوار نباشند



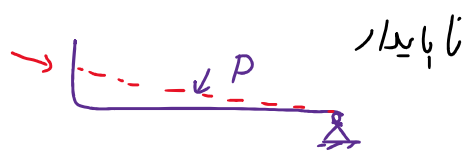
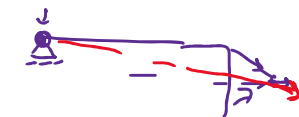
⑩ ترکیب از مفضل ومیده مناصل برهوس وصقیق درت استوار نباشند



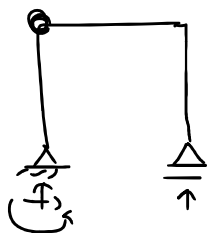
مثال:

$n=0$

بایدار



نا بایدار



$n=4-3=1$

تعداد معادلات - تعداد محبولات = n

درجه نامعین سازه:

محبولات تکیه گاه

تعداد محبولات تکیه گاه $|n|$

تعداد محبورات تکیه‌گاه (r)

① غلغلی



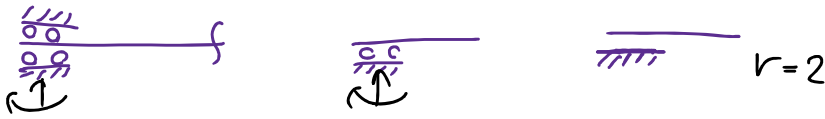
② مفصلی



③ مفصل بزرگ



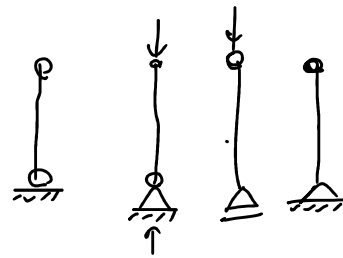
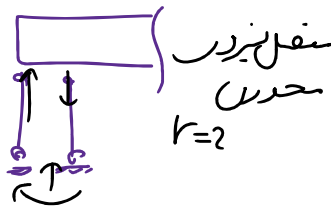
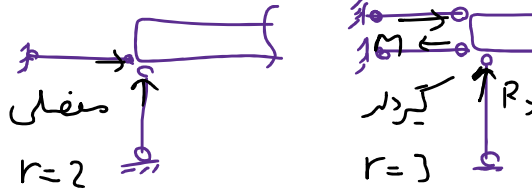
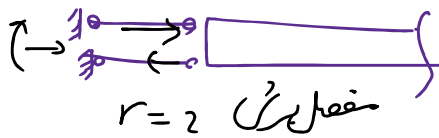
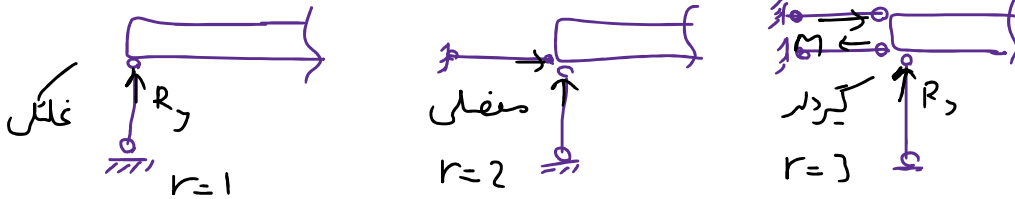
④ مفصل یزد محدود



⑤ گیردار

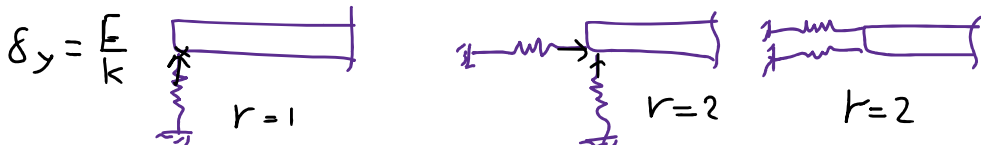


⑥ میله‌ها

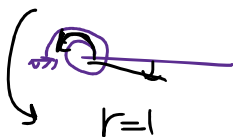


⑦ تکیه‌گاه لارجامی

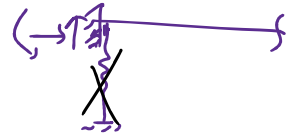
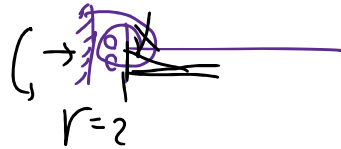
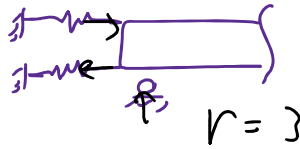
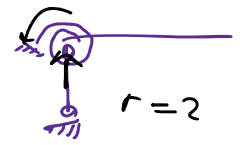
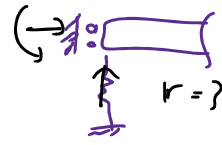
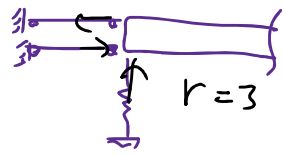
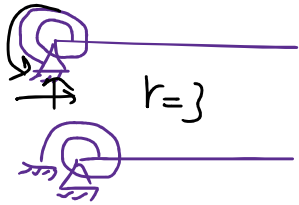
۱- فنر محدود



۲- فنر جزئی



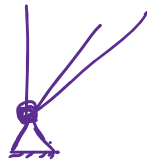
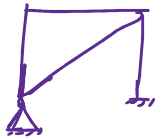
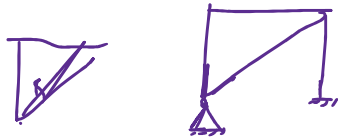
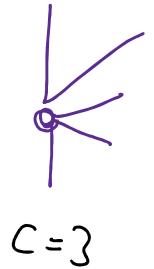
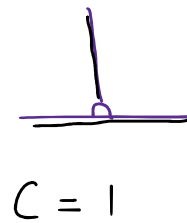
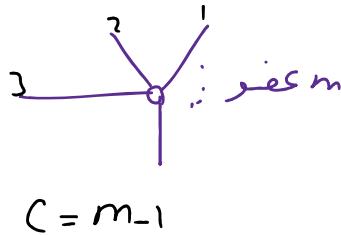
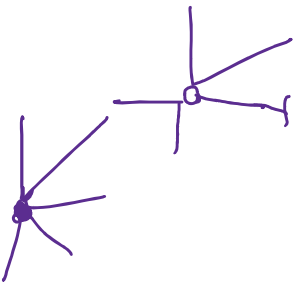
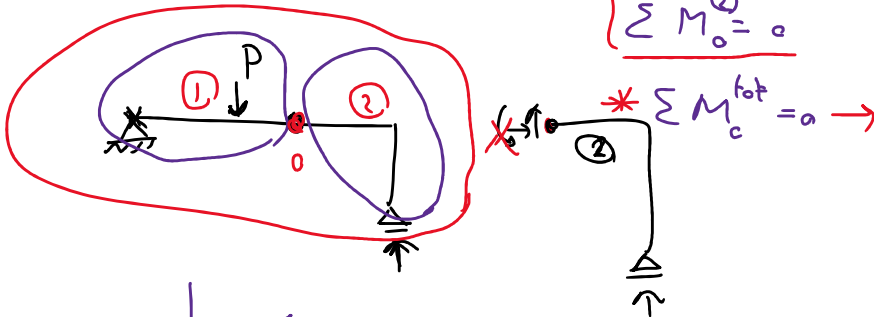
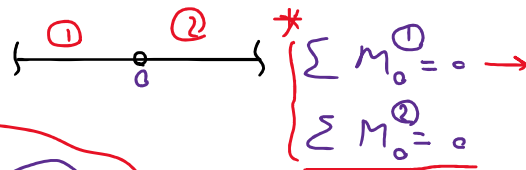
⑧ تکیه‌گاه ترکیبی



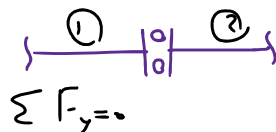
روابط شرطی
تعداد روابط شرطی (C)

① مفصل داخلی

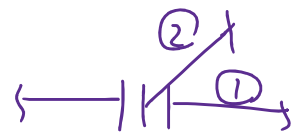
$C = 1$



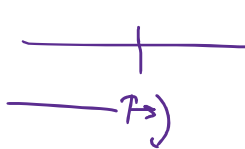
② مفصل بیرونی داخلی



$C = 1$

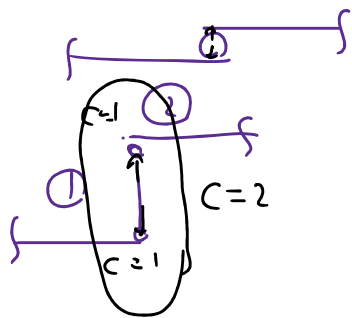


$C = 3 - 1 = 2$



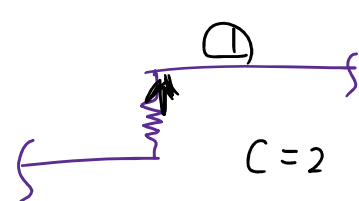
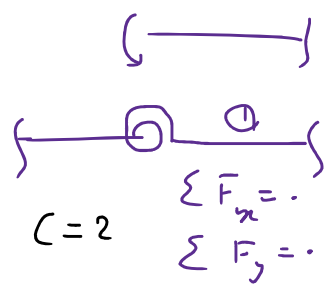
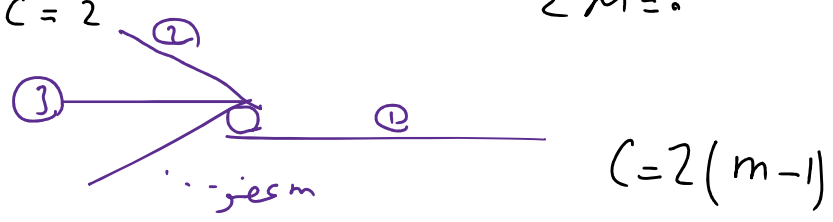
④ مفصل محدد داخلی
 $\sum F_x = 0 \quad C=1$

④ مفصل محدد داخلی



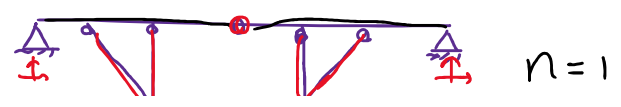
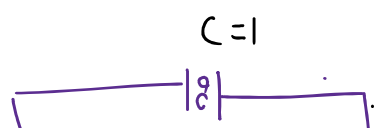
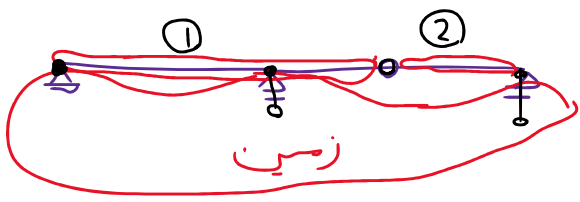
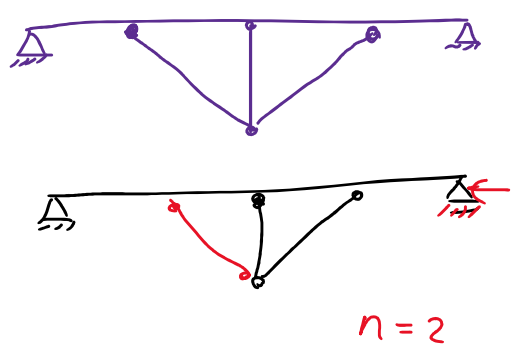
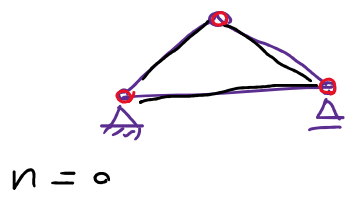
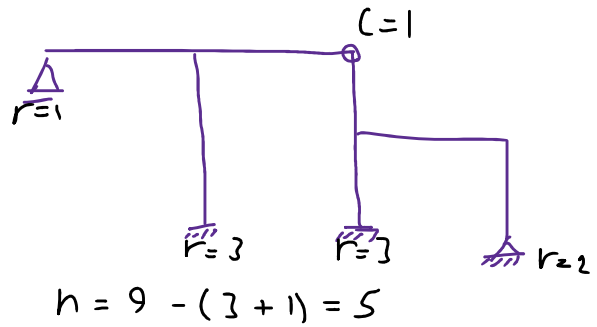
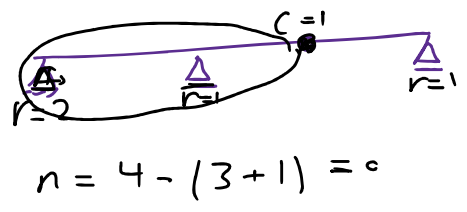
⑤ غلنگ داخلی
 $\sum F_x = 0$
 $\sum M = 0$
 $C=2$

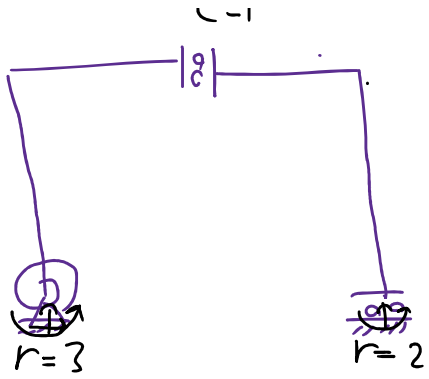
⑤ غلنگ داخلی



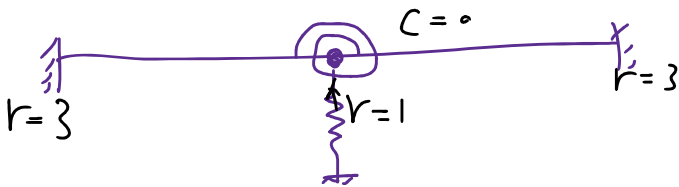
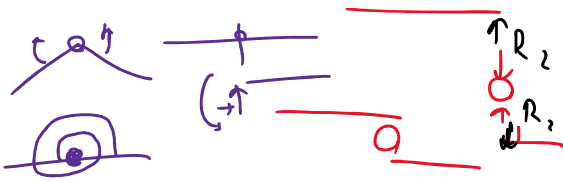
⑤ فنر داخلی

مثال:





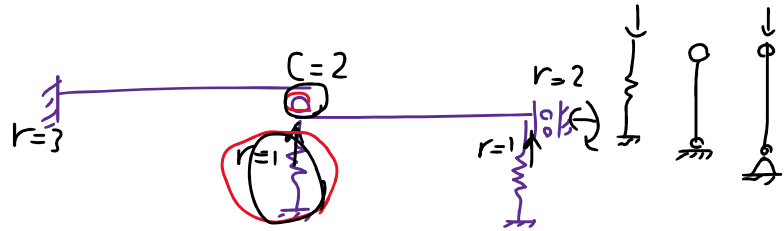
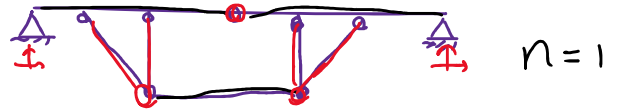
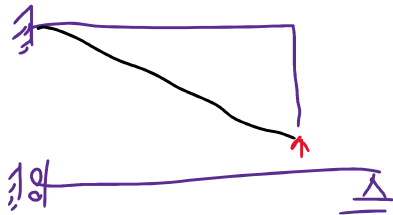
$$n = 5 - (3 + 1) = 1$$



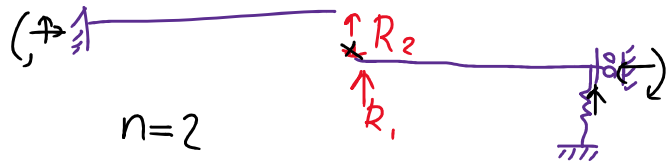
$$n = 7 - (3 + 0) = 4$$

کابل درشتی $n = 2$

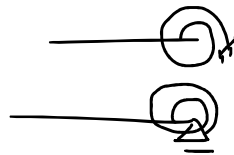
کابل درختار $n = 6 - (3 + 2) = 1$



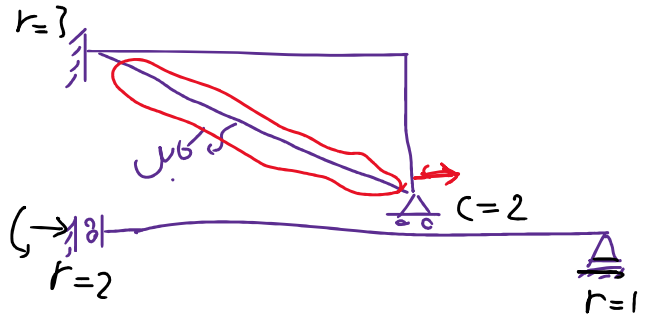
$$n = 7 - (3 + 2) = 2$$



$$n = 2$$



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$$n = 1$$

$$n = 2$$