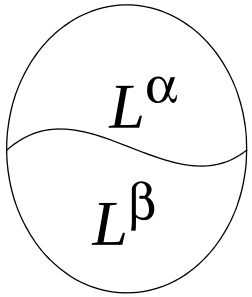
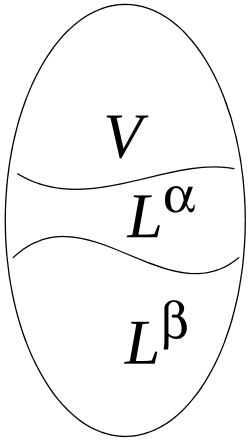
Criteria for equilibria



$$\hat{f}_i^{\alpha} = \gamma_i^{\alpha} x_i^{\alpha} P_i^{sat} = \gamma_i^{\beta} x_i^{\beta} P_i^{sat} = \hat{f}_i^{\beta}$$

$$\gamma_i^{\alpha} x_i^{\alpha} = \gamma_i^{\beta} x_i^{\beta}$$

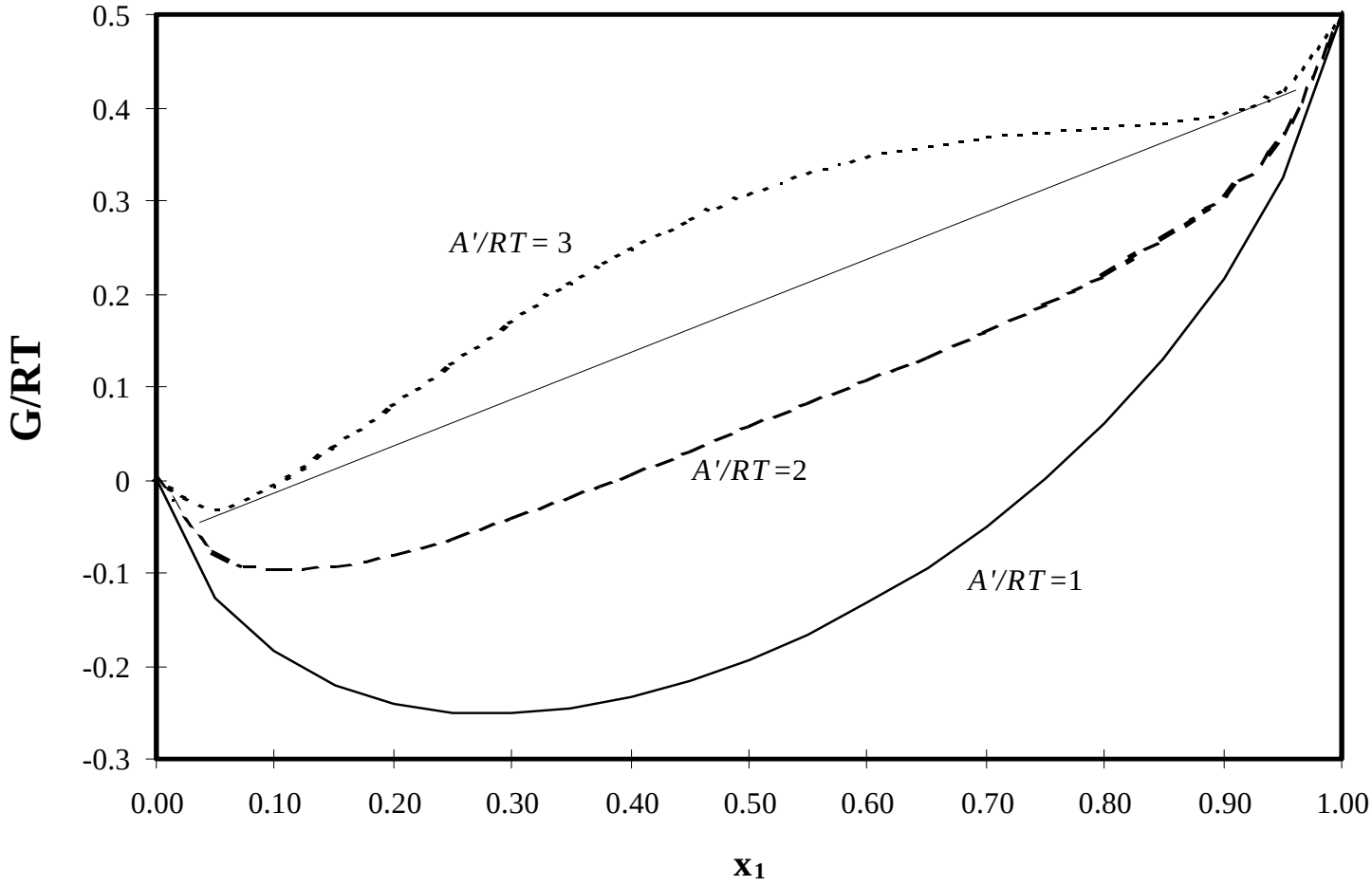


$$\hat{f}_i^{\alpha} = \gamma_i^{\alpha} x_i^{\alpha} P_i^{sat} = \gamma_i^{\beta} x_i^{\beta} P_i^{sat} = \hat{f}_i^{\beta} = y_i P = \hat{f}_i^{V}$$

$$\gamma_i^{\alpha} x_i^{\alpha} = \gamma_i^{\beta} x_i^{\beta} = y_i P$$

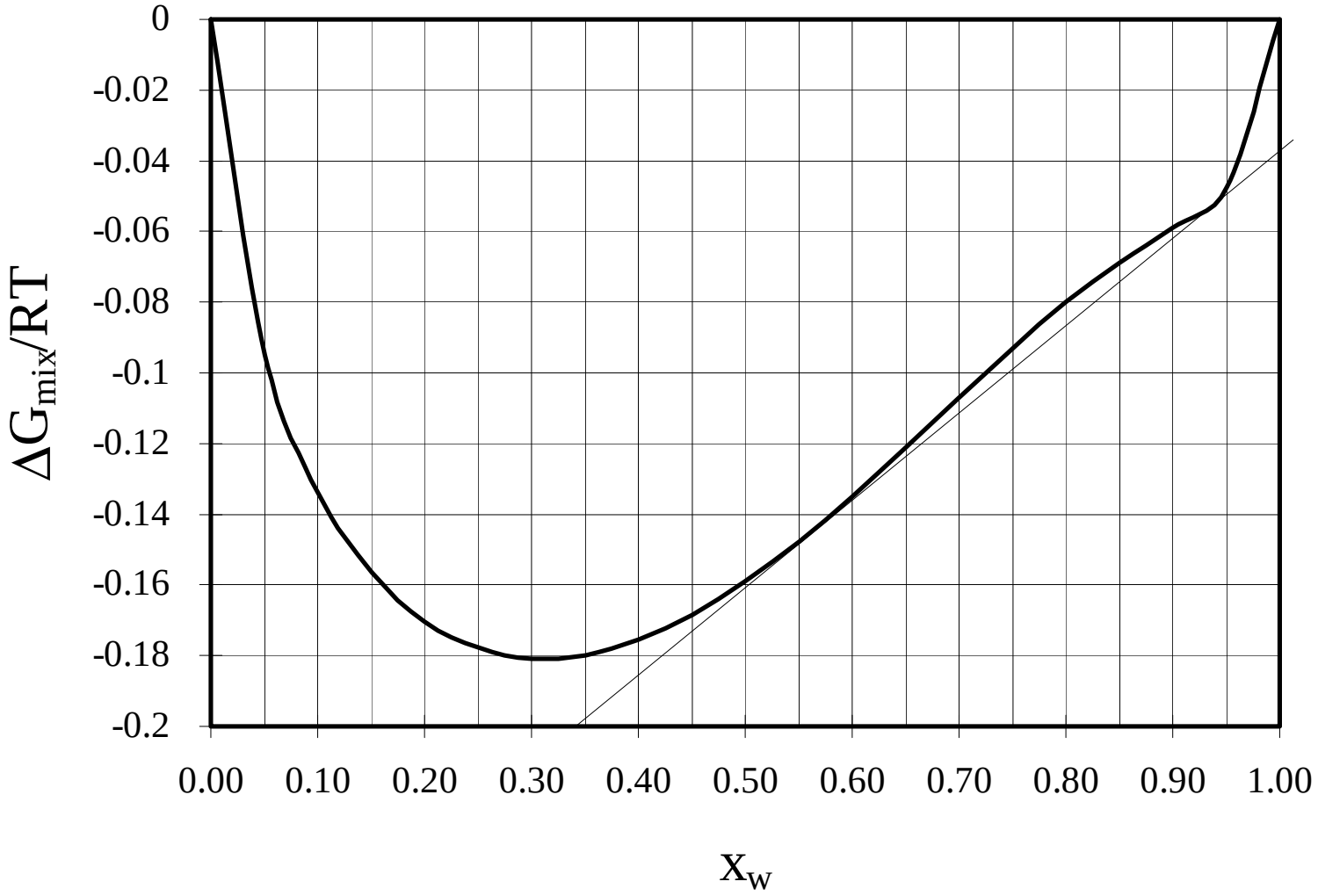
Simple Case of VLLE- virtually immiscible liquids

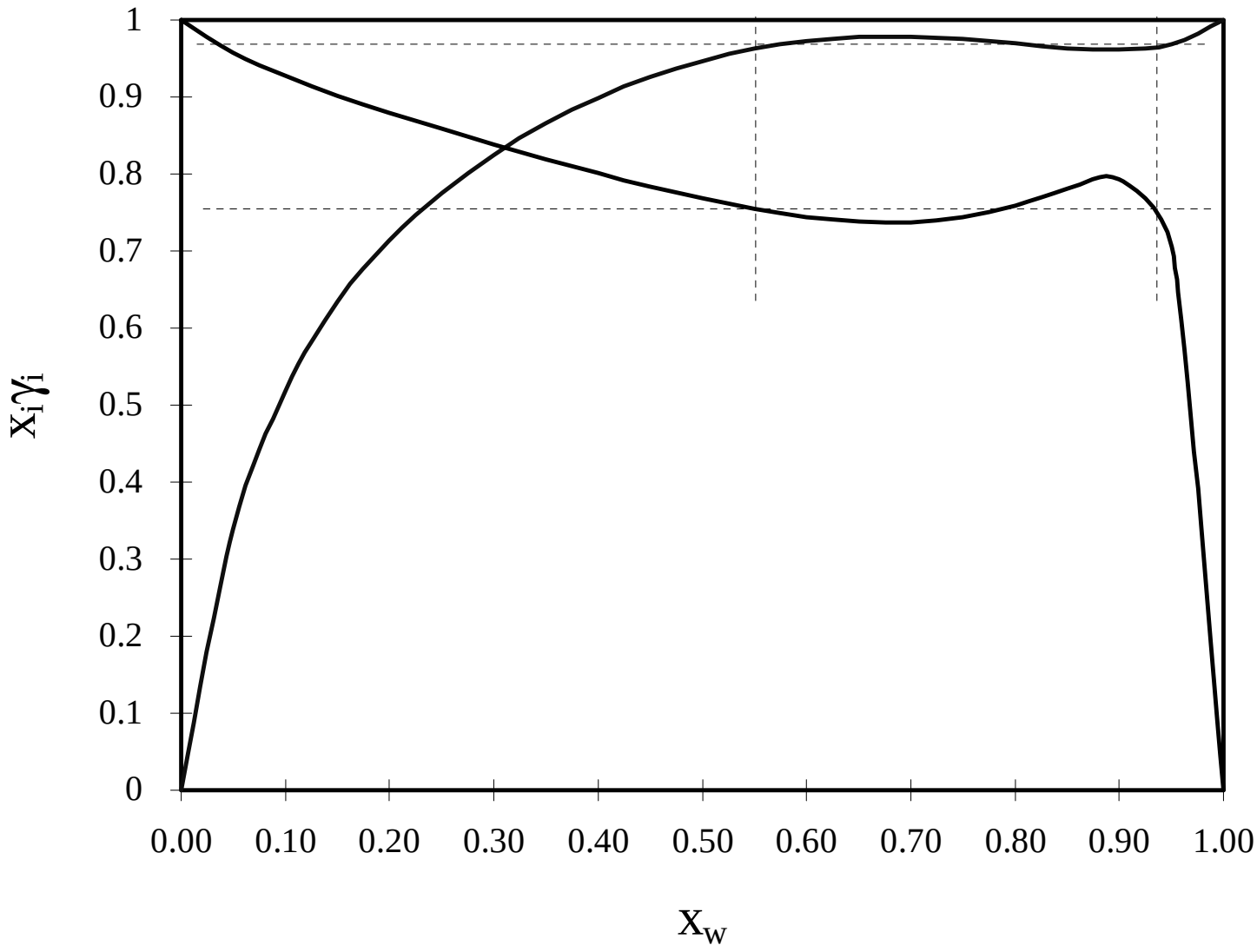
What causes LLE?



G curve related to G^E curve and ΔG_{mix}.

Calculation of Binary LLE using graphical technique.




1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
$x_i\gamma_i$
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
X_w

LLE by binary flash

$$x_1^{\alpha} K_1 + (1 - x_1^{\alpha}) K_2 = 1 \Rightarrow x_1^{\alpha} = \frac{1 - K_2}{K_1 - K_2}; \text{ and } x_1^{\beta} = x_1^{\alpha} K_1$$

Initialize:

1. Calculating $x_{1,\,new}^{\alpha} = \dfrac{1 - K_{2,\,old}}{K_{1,\,old} - K_{2,\,old}}$,

$$x_{2new}^{\alpha} = 1 - x_{1new}^{\alpha};$$

2. Calculating $x_{i,new}^{\beta} = K_{i,old} x_{i,new}^{\alpha}$;

3. Determining $\gamma_{i,new}$ values for each liquid phase from the $x_{i,new}$ values;

4. Calculating $K_{i,\,new} = \dfrac{\gamma_i^{\alpha}}{\gamma_i^{\beta}}$;

5. Replacing all $x_{i,old}$ and $K_{i,old}$ values with the corresponding new values;

6. Repeating the iterations until calculations converge.

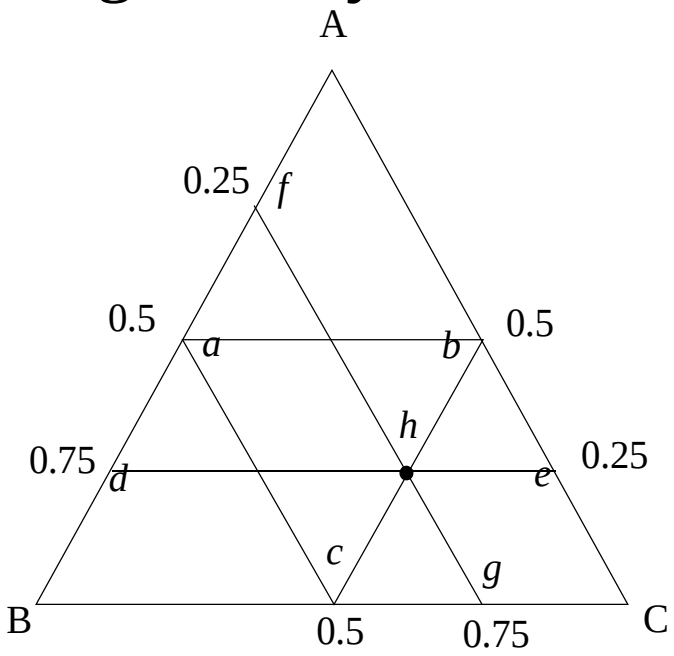
iteration	x_1^{α}	x_1^{β}	$K_{1,new}$	$K_{2,new}$
initialize	1	0	0.0425	45.758
1	0.979	0.0416	0.0859	32.202
2	0.972	0.083	0.1129	25.93
3	0.966	0.109	0.1359	22.99
4	0.962	0.131	0.1566	21.28
5	0.9601	0.1504	0.1758	20.199
30	0.958	0.342	0.276	15.716
40	0.958	0.349	0.365	15.555
50	0.958	0.354	0.369	15.47

VLLE equilibrium in mixed system (simple)

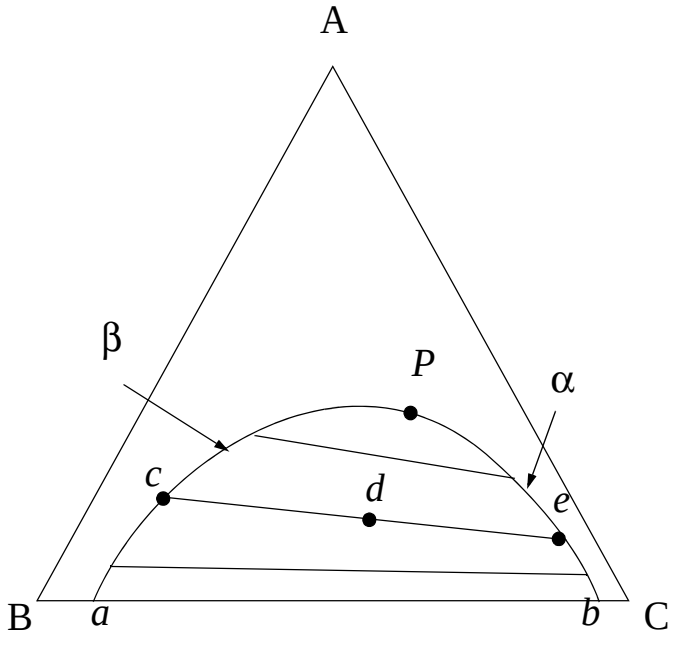
	y_i	T_c	P_c	ω
n-C8	0.20	568.8	2.486	0.396
C12 fraction	0.40	660.0	2.000	0.540
H_2O	0.40	(use steam tables)		

	phase	x_i	*VLE* K_i (353)	y_i	*VLE* K_i (368)	y_i
n-C8	α	0.333	0.254	0.084	0.415	0.138
C12 fraction	α	0.667	0.015	0.010	0.028	0.019
H_2O	β	1.0	0.474	0.474	0.846	0.846
				0.568		1.0027

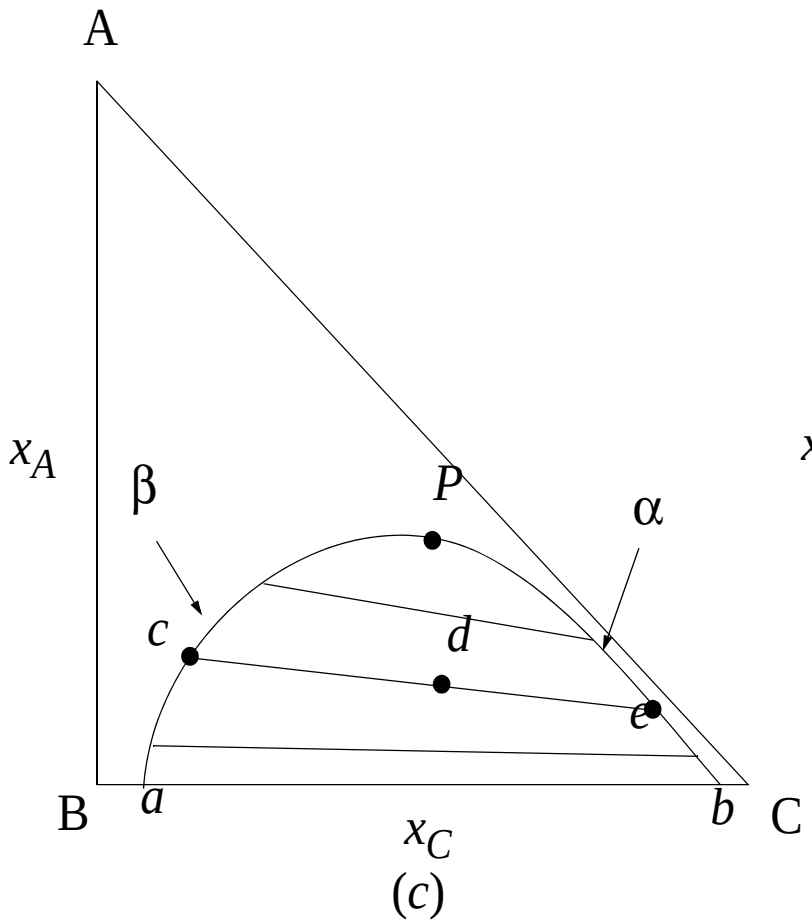
Plotting Ternary Data



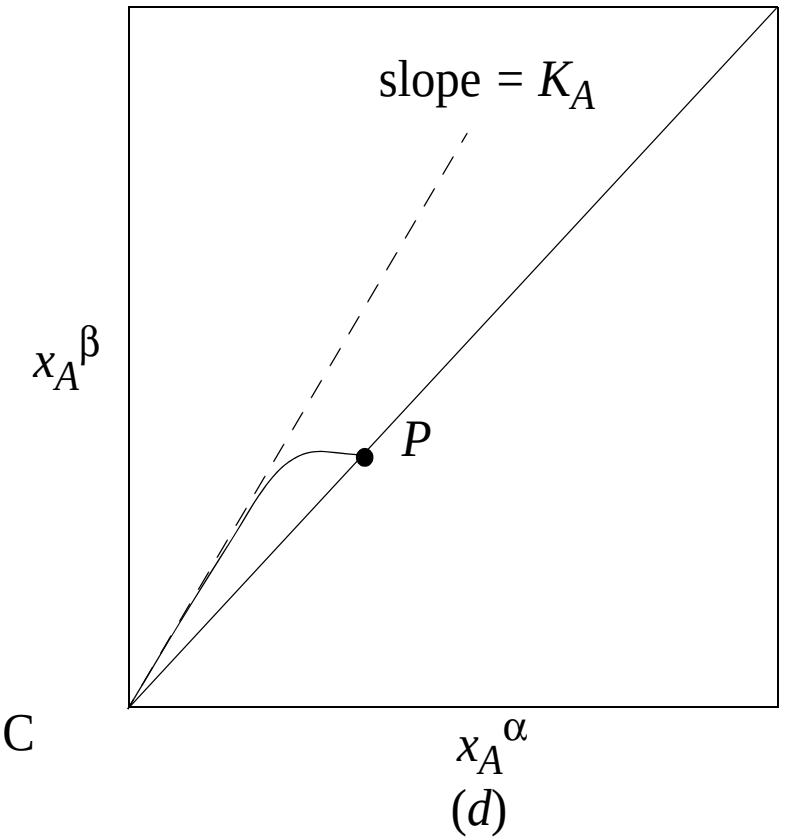
(*a*)



(*b*)



(*c*)



(*d*)