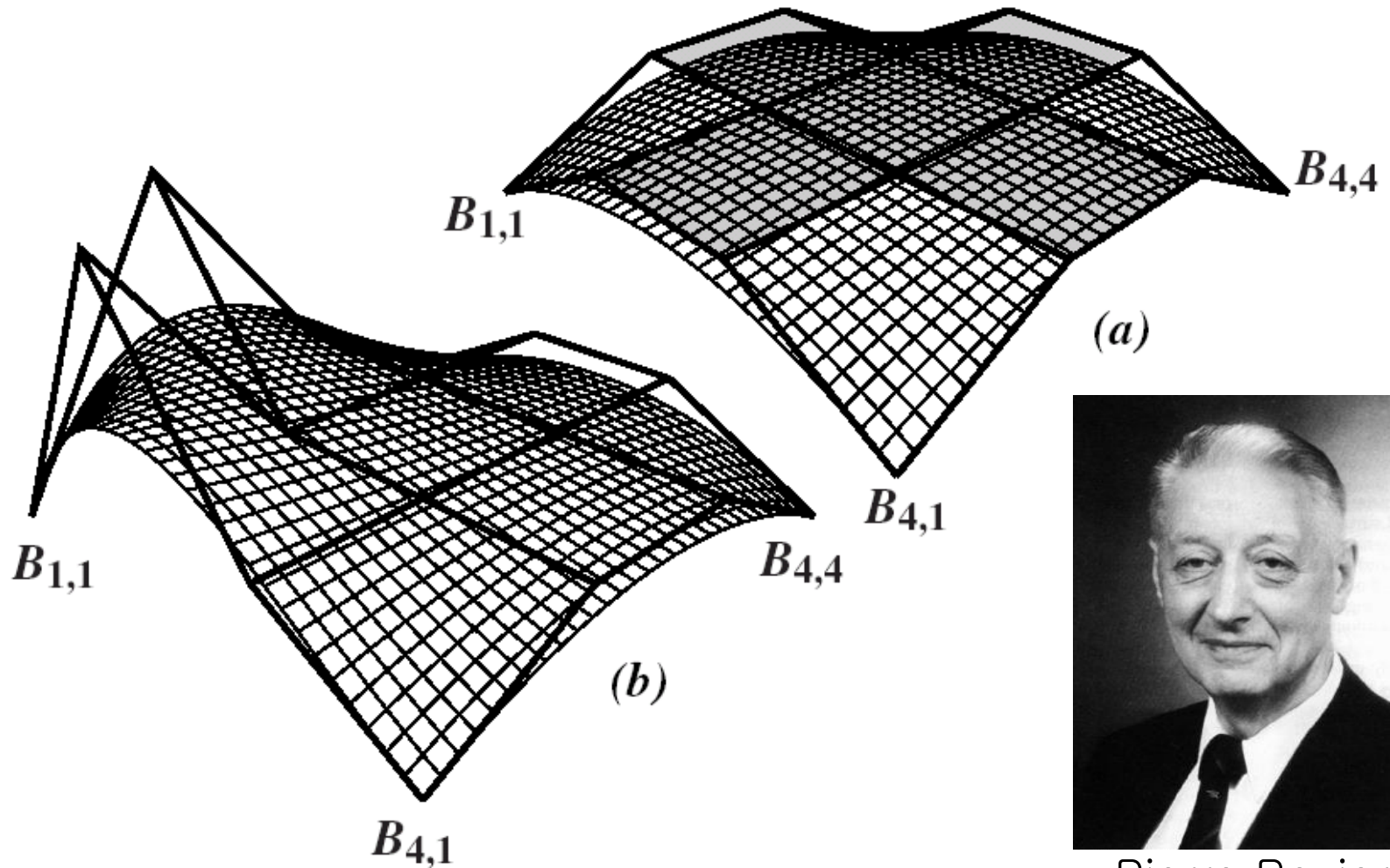


Bezier Surfaces



Pierre Bezier

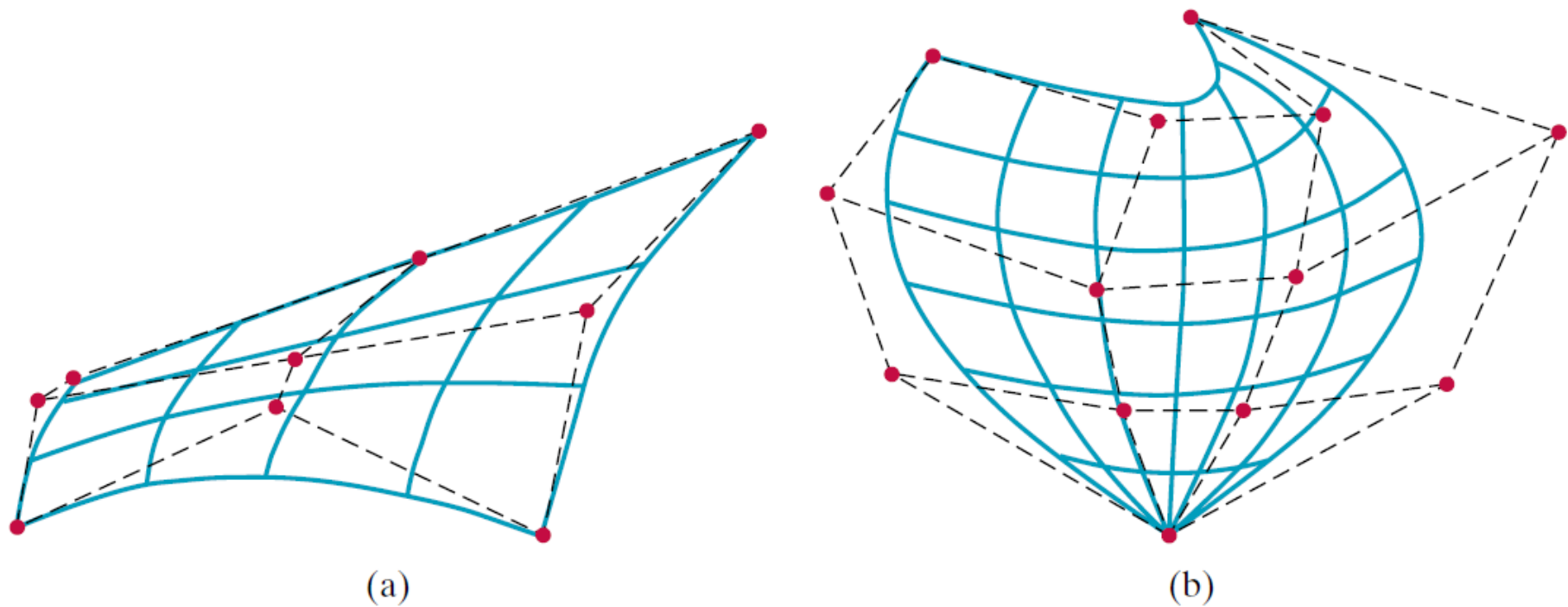
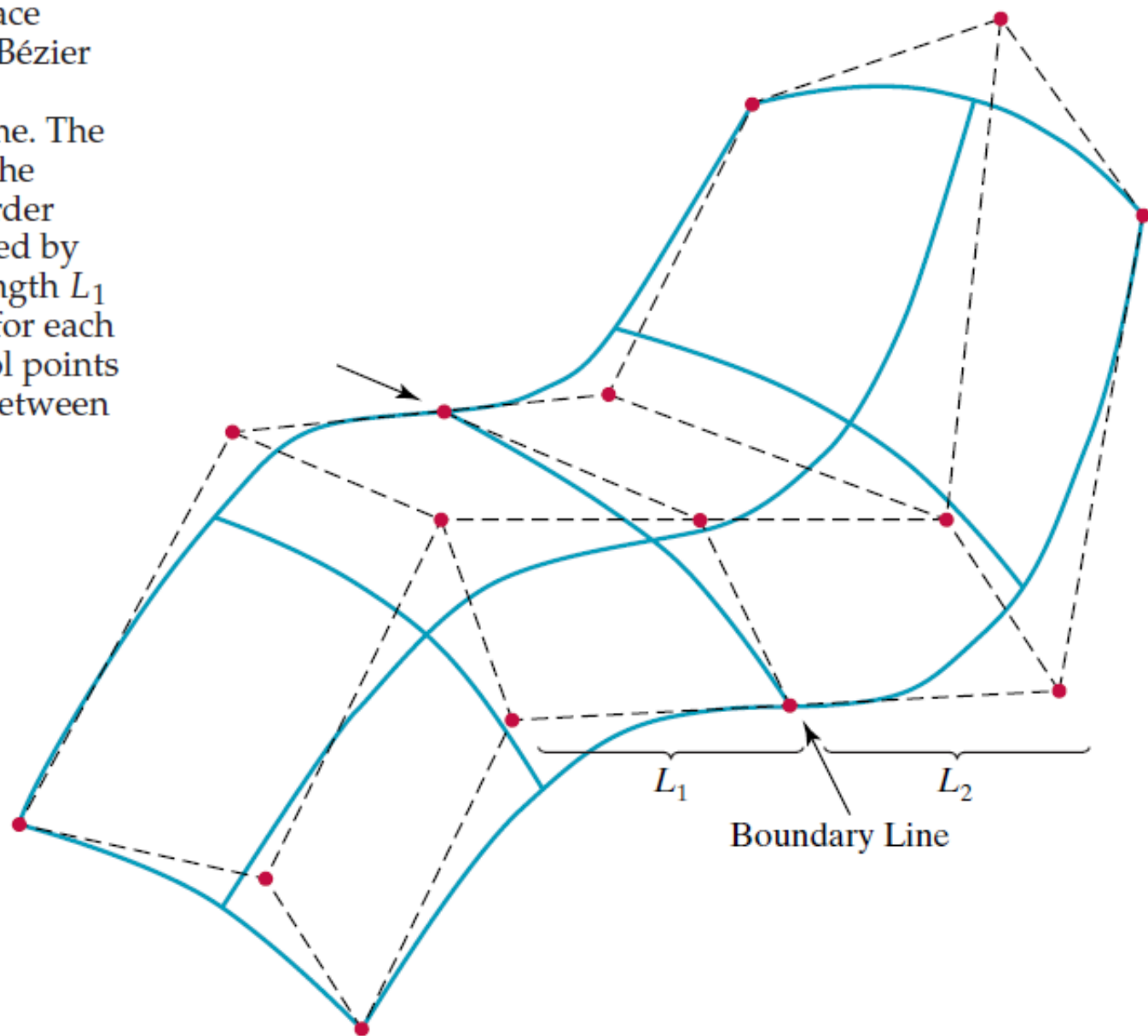


FIGURE 8-39 Wire-frame Bézier surfaces constructed with (a) nine control points arranged in a 3 by 3 mesh and (b) sixteen control points arranged in a 4 by 4 mesh. Dashed lines connect the control points.

FIGURE 8-40 A composite Bézier surface constructed with two Bézier sections, joined at the indicated boundary line. The dashed lines connect the control points. First-order continuity is established by making the ratio of length L_1 to length L_2 constant for each collinear line of control points across the boundary between the surface sections.



$$\begin{aligned}
S(u, v) &= \sum_{i=0}^3 \sum_{j=0}^3 \mathbf{p}_{ij} B_i^3(u) B_j^3(v) \\
&= \begin{bmatrix} B_0^3(u) & B_1^3(u) & B_2^3(u) & B_3^3(u) \end{bmatrix} \begin{bmatrix} \mathbf{p}_{00} & \mathbf{p}_{01} & \mathbf{p}_{02} & \mathbf{p}_{03} \\ \mathbf{p}_{10} & \mathbf{p}_{11} & \mathbf{p}_{12} & \mathbf{p}_{13} \\ \mathbf{p}_{20} & \mathbf{p}_{21} & \mathbf{p}_{22} & \mathbf{p}_{23} \\ \mathbf{p}_{30} & \mathbf{p}_{31} & \mathbf{p}_{32} & \mathbf{p}_{33} \end{bmatrix} \begin{bmatrix} B_0^3(v) \\ B_1^3(v) \\ B_2^3(v) \\ B_3^3(v) \end{bmatrix}
\end{aligned}$$

$$B_0^3 = (1 - u)^3, B_1^3(u) = 3(1 - u)^2 u,$$

$$B_2^3(u) = 3(1 - u) u^2, B_3^3(u) = u^3$$