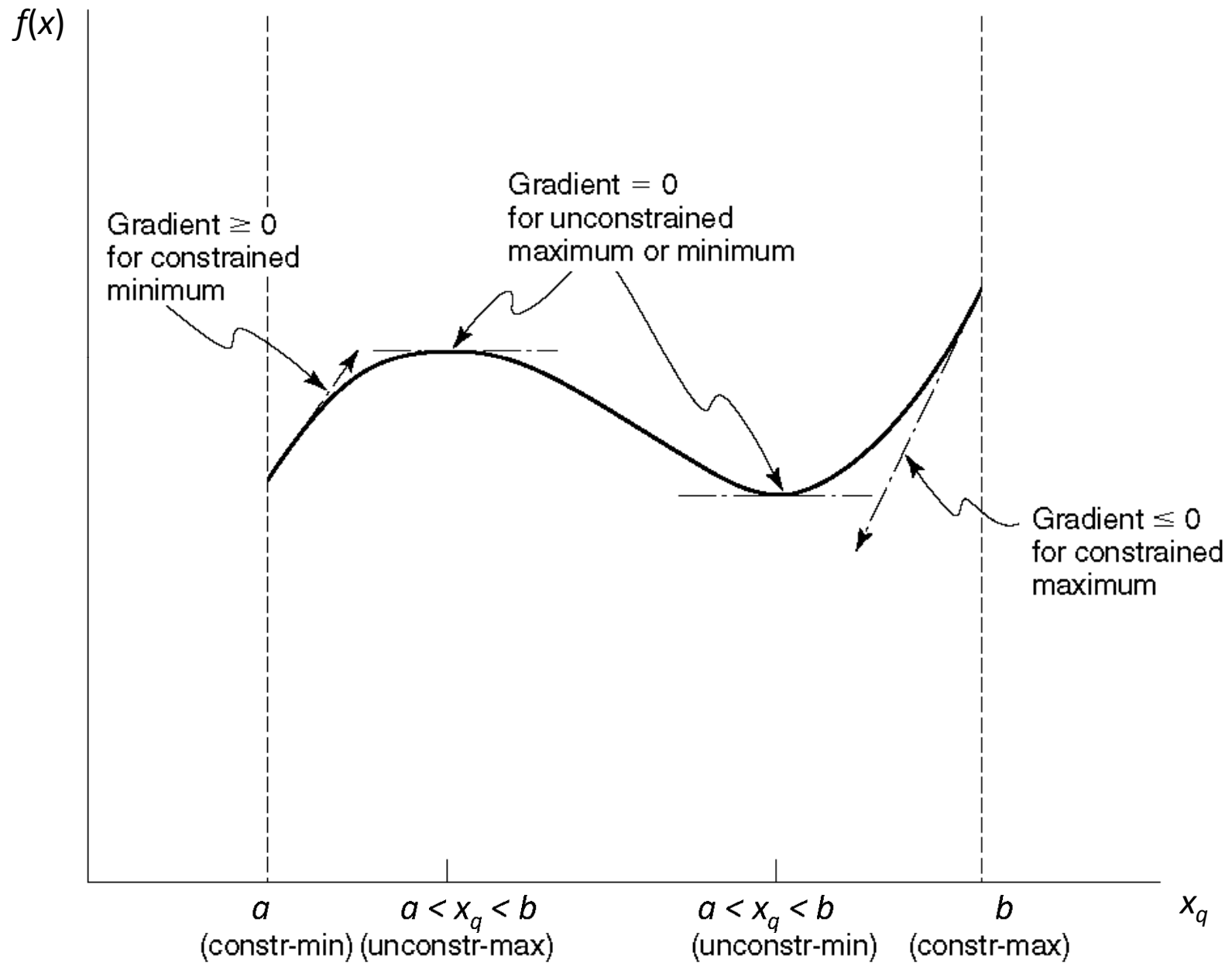
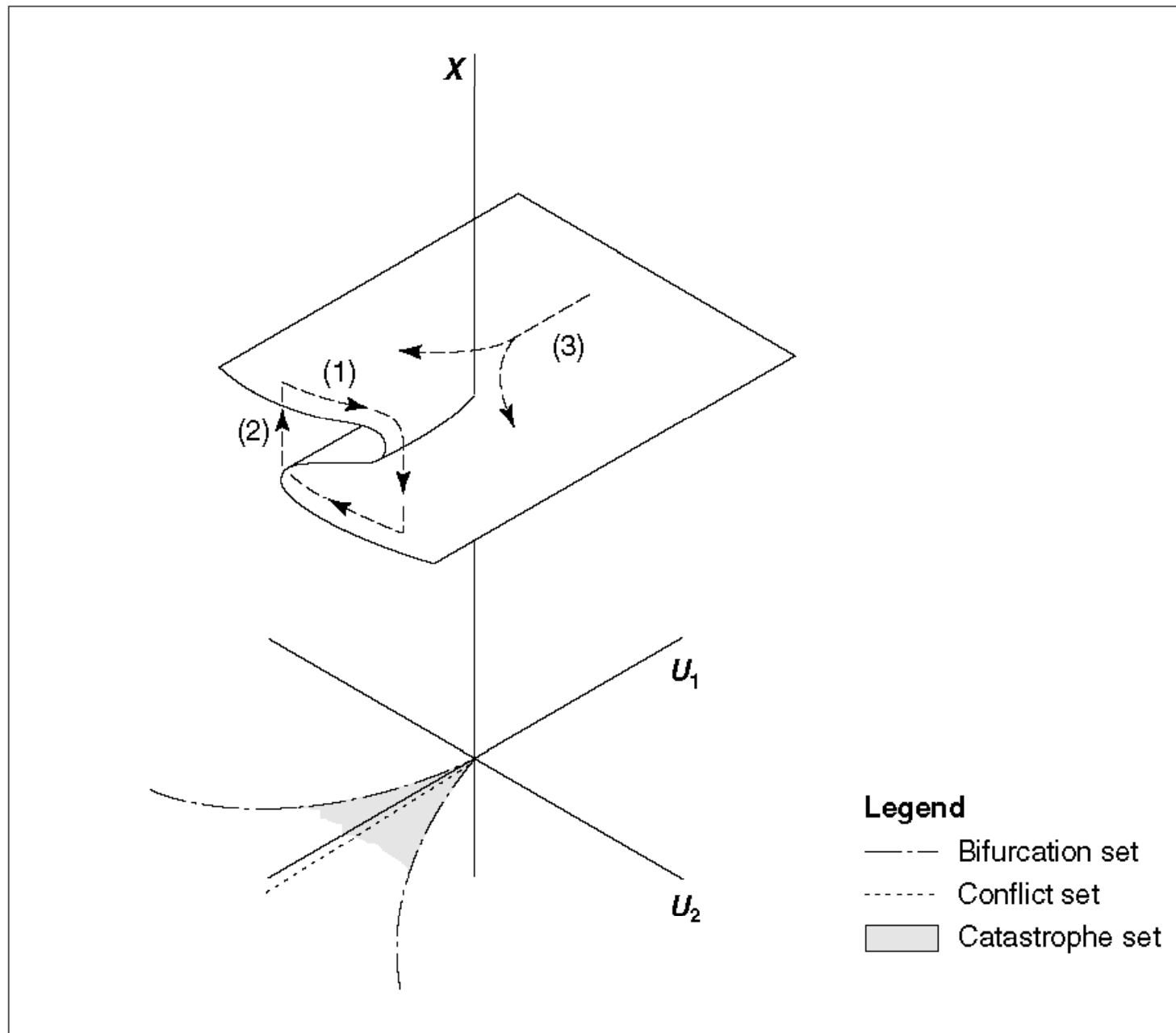


**Figure A1.1** ILLUSTRATION OF VARIATIONAL INEQUALITY

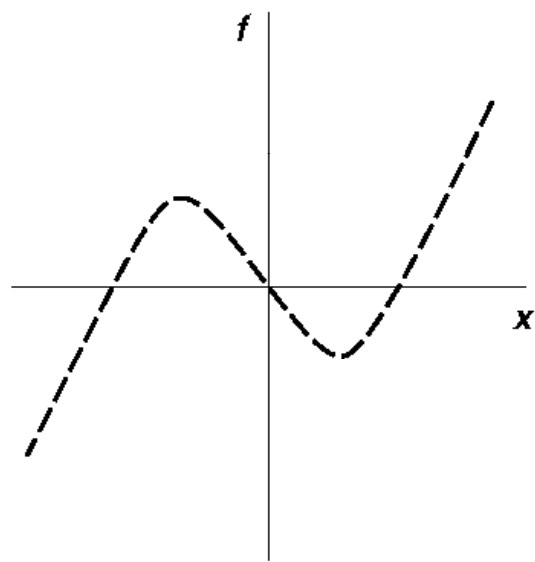


**Figure A1.2** THE CUSP SURFACE

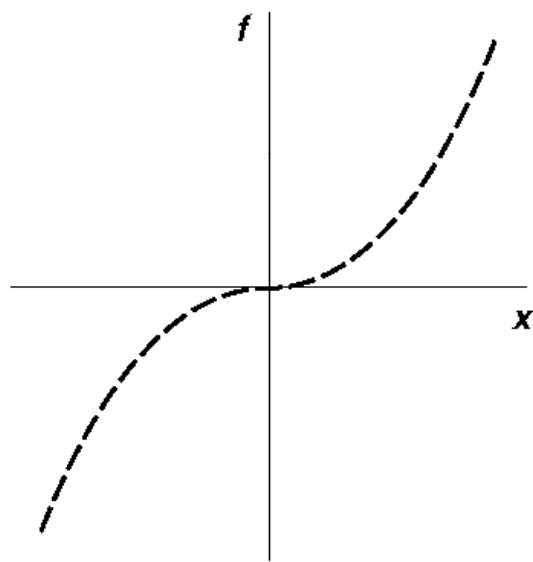


SOURCE: Wilson (1981). Reprinted with permission.

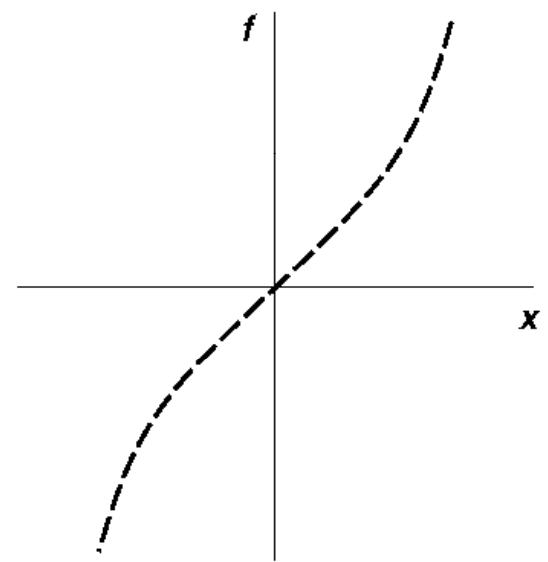
**Figure A1.3** ILLUSTRATING STRUCTURAL STABILITY



(a)  $U < 0$

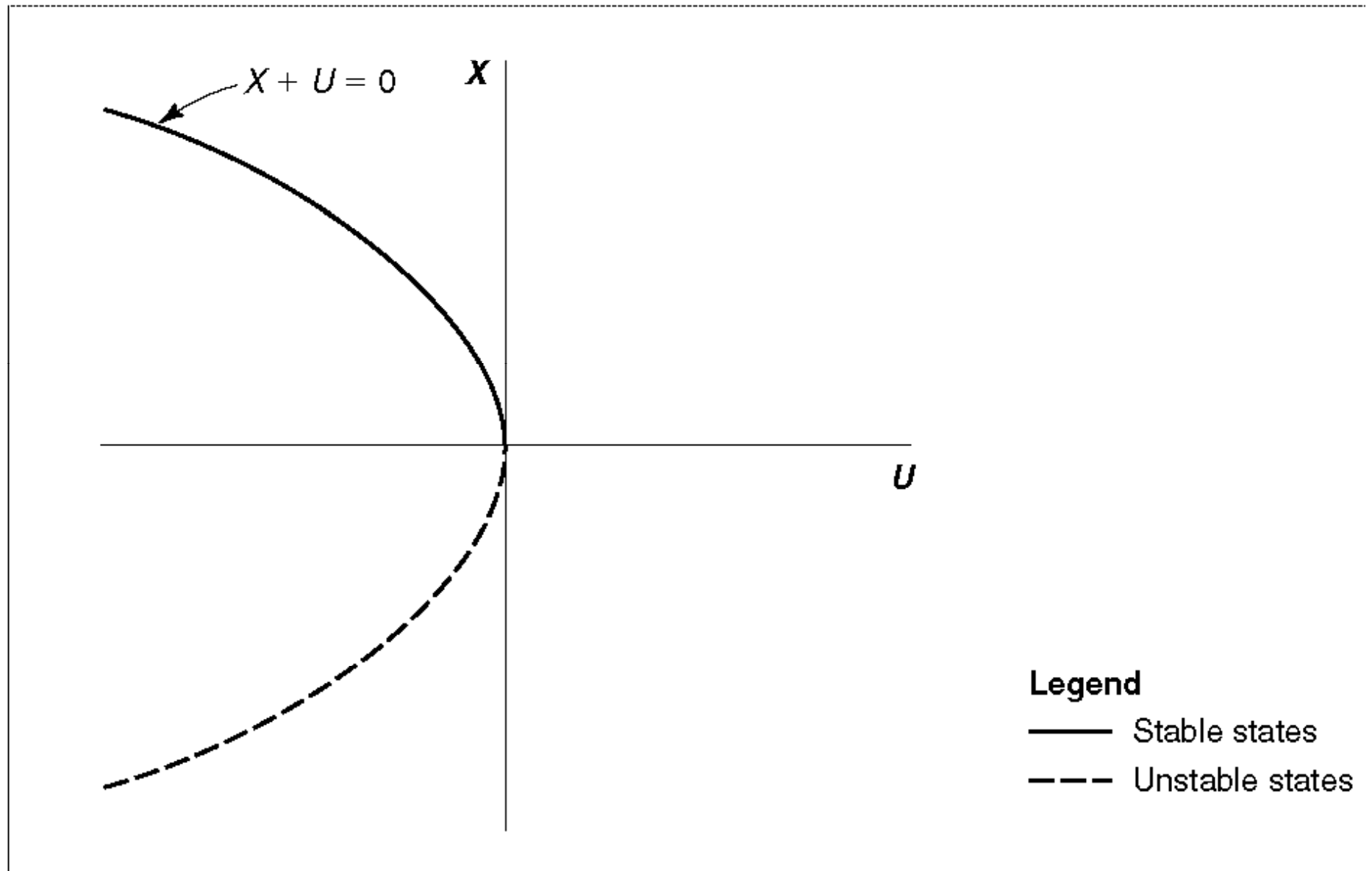


(b)  $U = 0$



(c)  $U > 0$

**Figure A1.4** EXAMPLE OF A FOLD CATASTROPHE



SOURCE: Wilson (1981). Reprinted with permission.

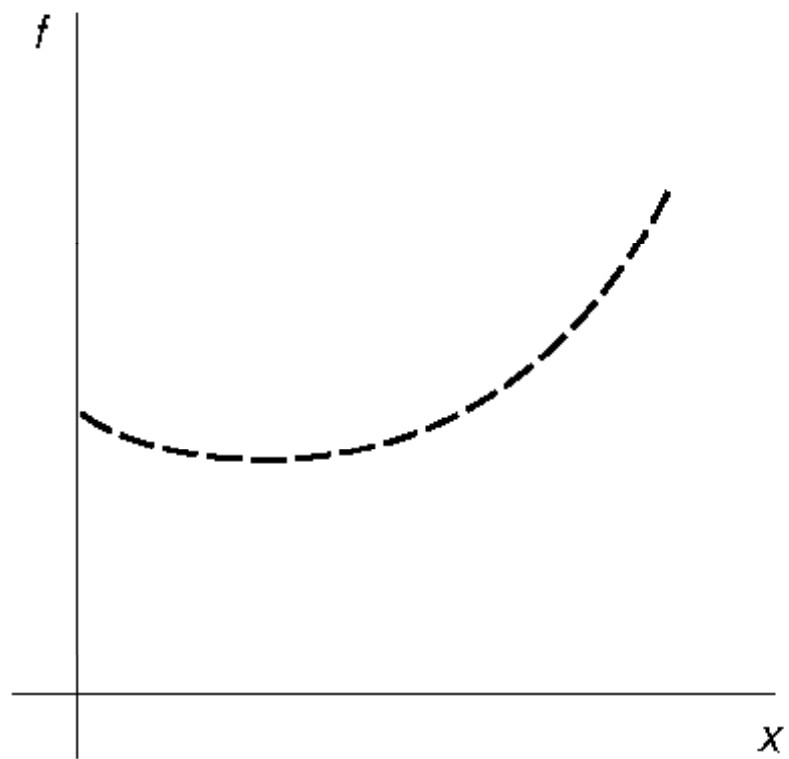
**Table A1.1** THE SEVEN ELEMENTARY CATASTROPHES

| Name                            | State variables | Control variables/<br>Co-dimension | Potential function   |
|---------------------------------|-----------------|------------------------------------|--|
| Fold <sup>a</sup>               | 1               | 1                                  | $X_1^3/3 + U_1X_1$   |
| Cusp                            | 1               | 2                                  | $X_1^4/4 + U_1X_1^2/2 + U_2X_1$                                    |
| Swallow tail <sup>a</sup>       | 1               | 3                                  | $X_1^5/5 + U_1X_1^3 + 3 + U_2X_1^2/2 + U_3X_1$                     |
| Hyperbolic <sup>a</sup> umbilic | 2               | 3                                  | $X_1^3/3 + X_2^3/3 + U_1X_1X_2 - U_2X_1 - U_3X_2$                  |
| Elliptic <sup>a</sup> umbilic   | 2               | 3                                  | $X_1^3/3 - X_1X_2^2/2 + U_1(X_1^2X_2^2)/2 - U_2X_1 - U_3X_2$       |
| Butterfly                       | 1               | 4                                  | $X_1^6/6 + U_1X_1^4/4 + U_2X_1^3/3 + U_3X_1^2/2 + U_4X_1$          |
| Parabolic umbilic               | 2               | 4                                  | $X_1^2X_2/2 + X_2^4/4 + U_1X_1^2/2 + U_2X_2^2/2 - U_3X_1 - U_4X_1$ |

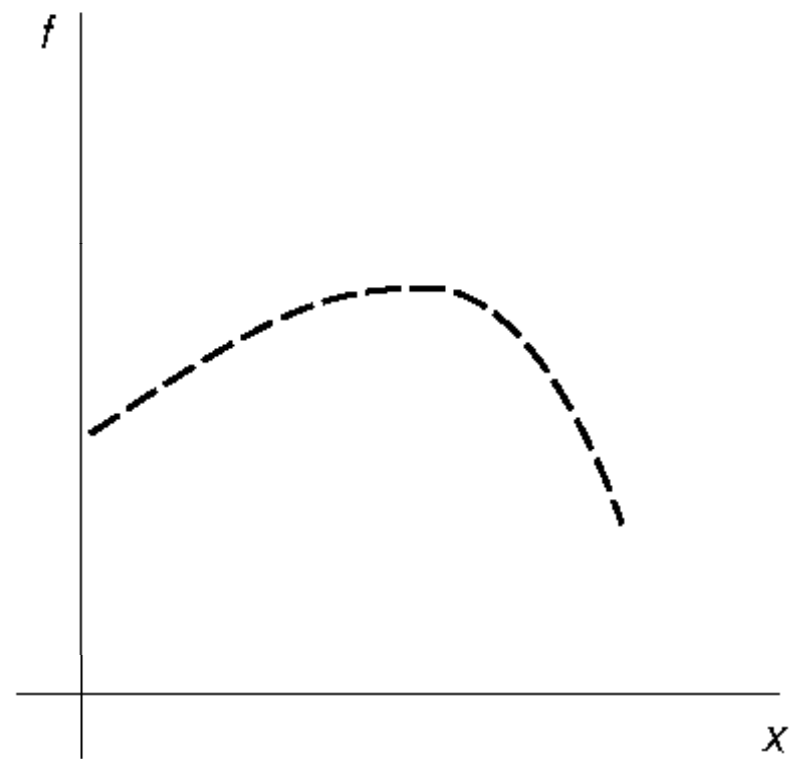
<sup>a</sup> These unfolding functions are self-duals.

SOURCE: Wilson (1981). Reprinted with permission.

**Figure A1.5** LOCAL OPTIMA CREATED BY A CONSTRAINT

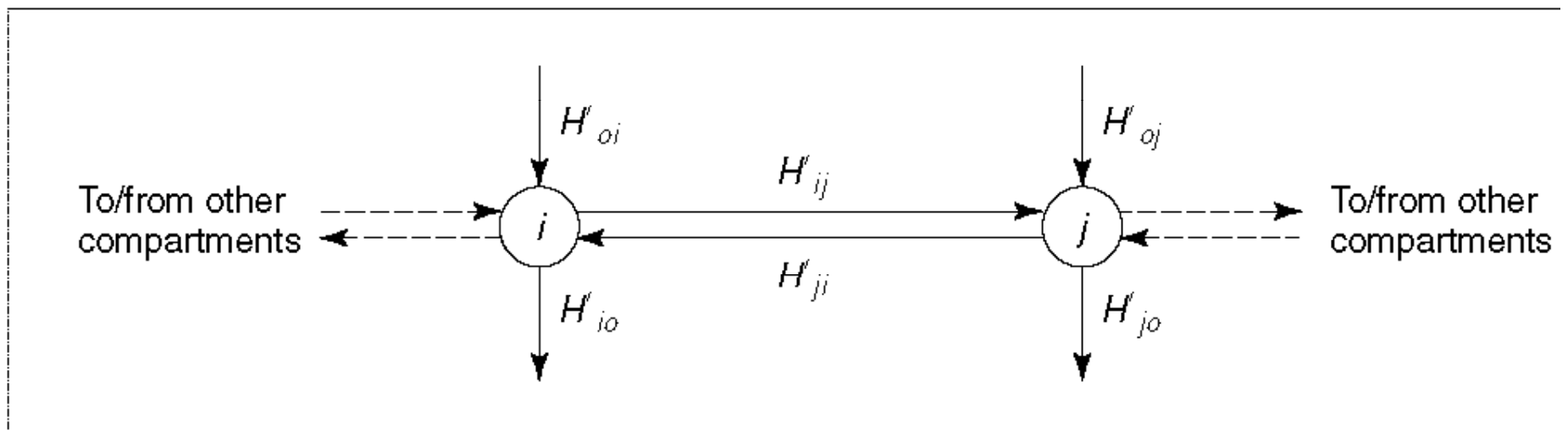


(a) Local max at  $X = 0$



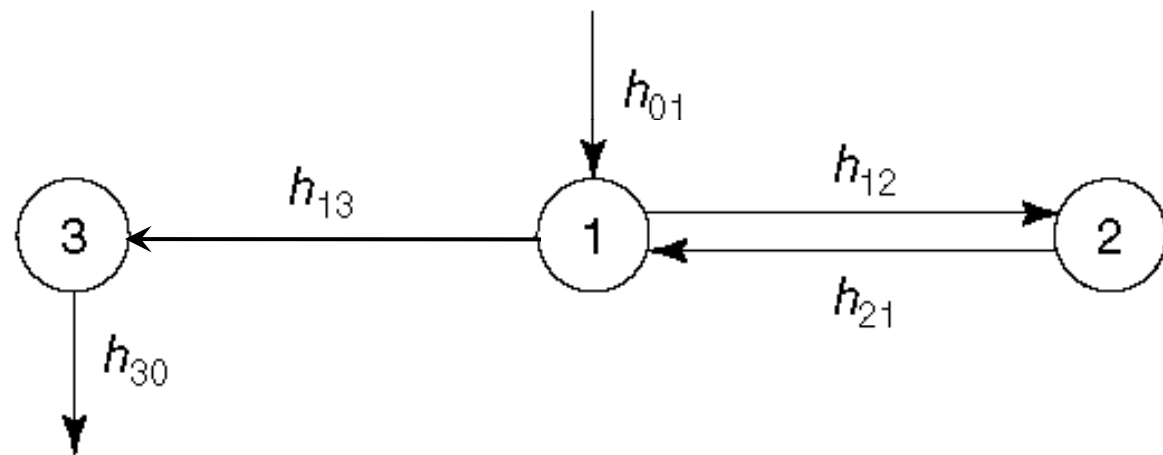
(b) Local min at  $X = 0$

**Figure A1.6** ILLUSTRATING TWO COMPARTMENTS OF A GENERAL COMPARTMENTAL MODEL



SOURCE: Godfrey (1983). Reprinted with permission.

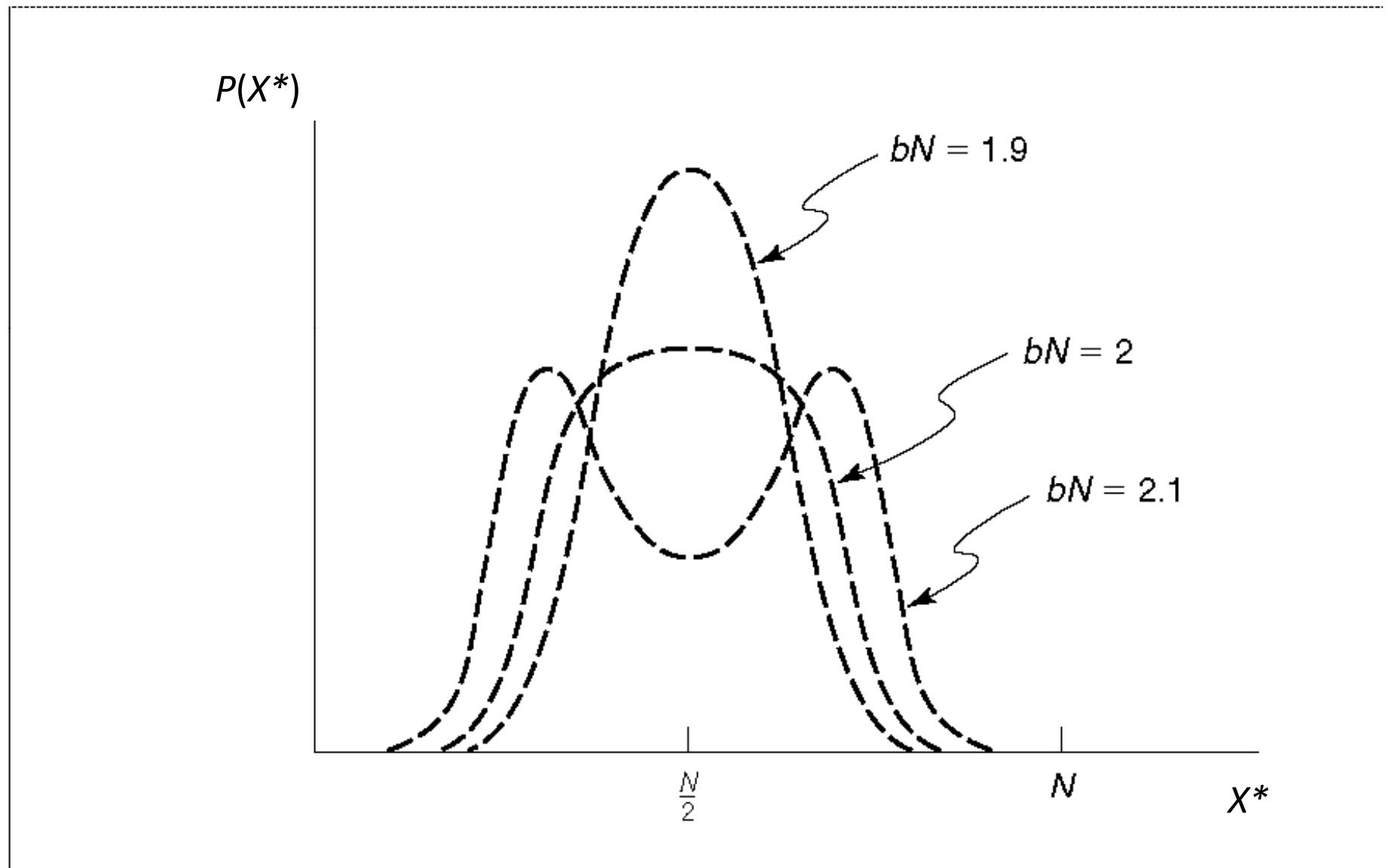
**Figure A4.7** ILLUSTRATING A THREE-COMPARTMENT MODEL



SOURCE: Seber and Wild (1989). Reprinted with permission.

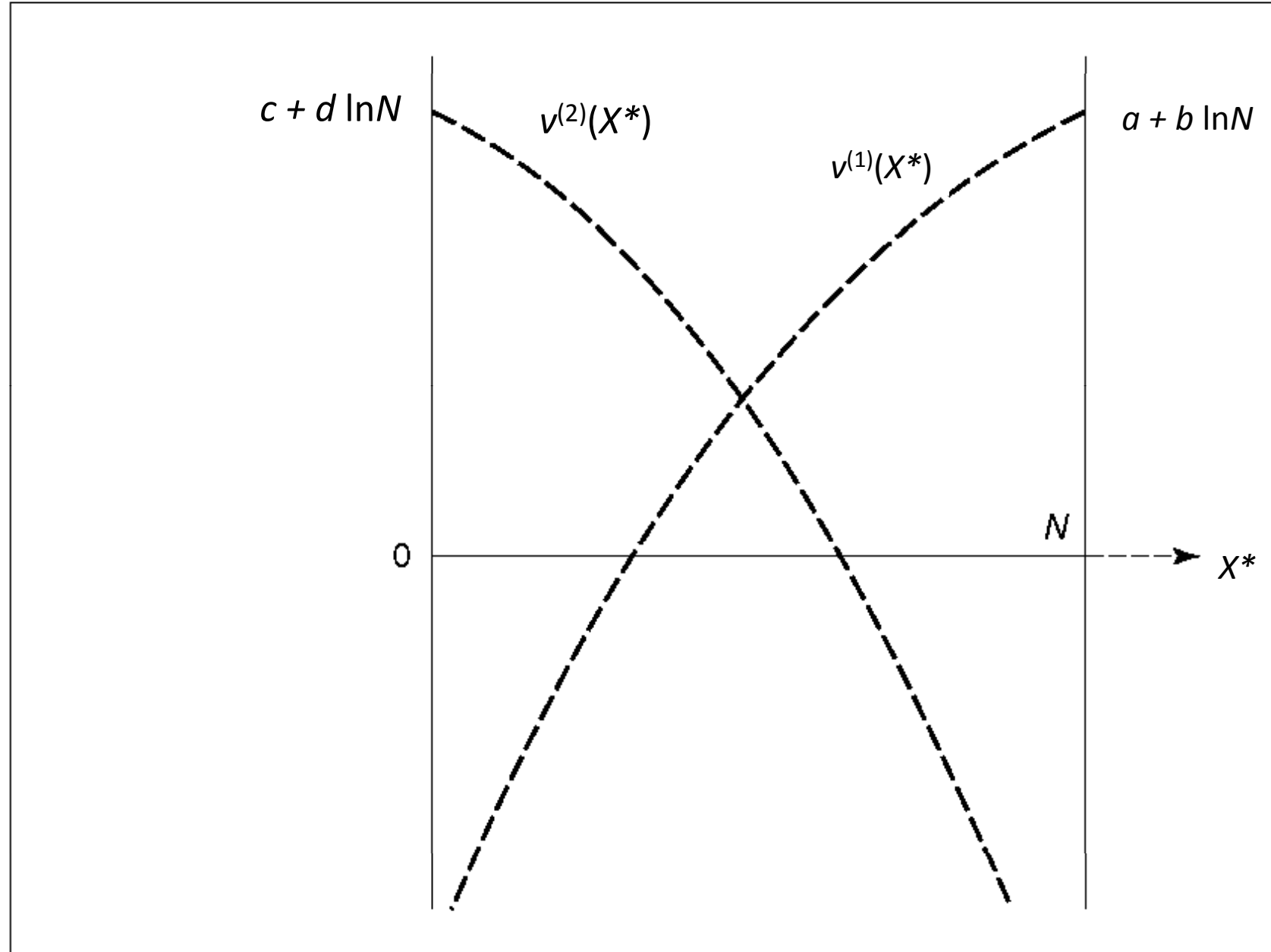


**Figure A1.8** STATIONARY DISTRIBUTION IN THE NONLINEAR CASE  
WHEN  $\mu = 1$



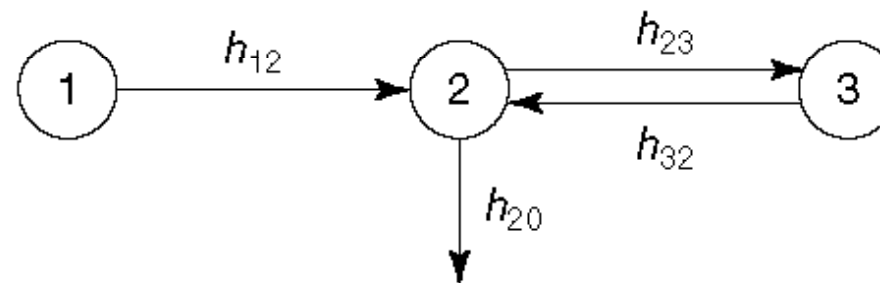
SOURCE: dePalma and Lefèvre (1987). Reprinted with permission.

**Figure A1.9** LOGARITHMIC UTILITY FUNCTION



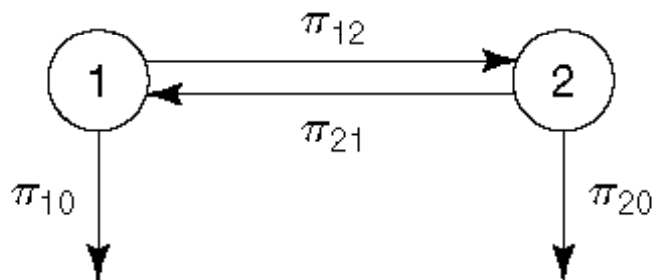
SOURCE: dePalma and Lefèvre (1987). Reprinted with permission.

**Figure A1.10** EXAMPLE OF A DETERMINISTIC COMPARTMENTAL MODEL



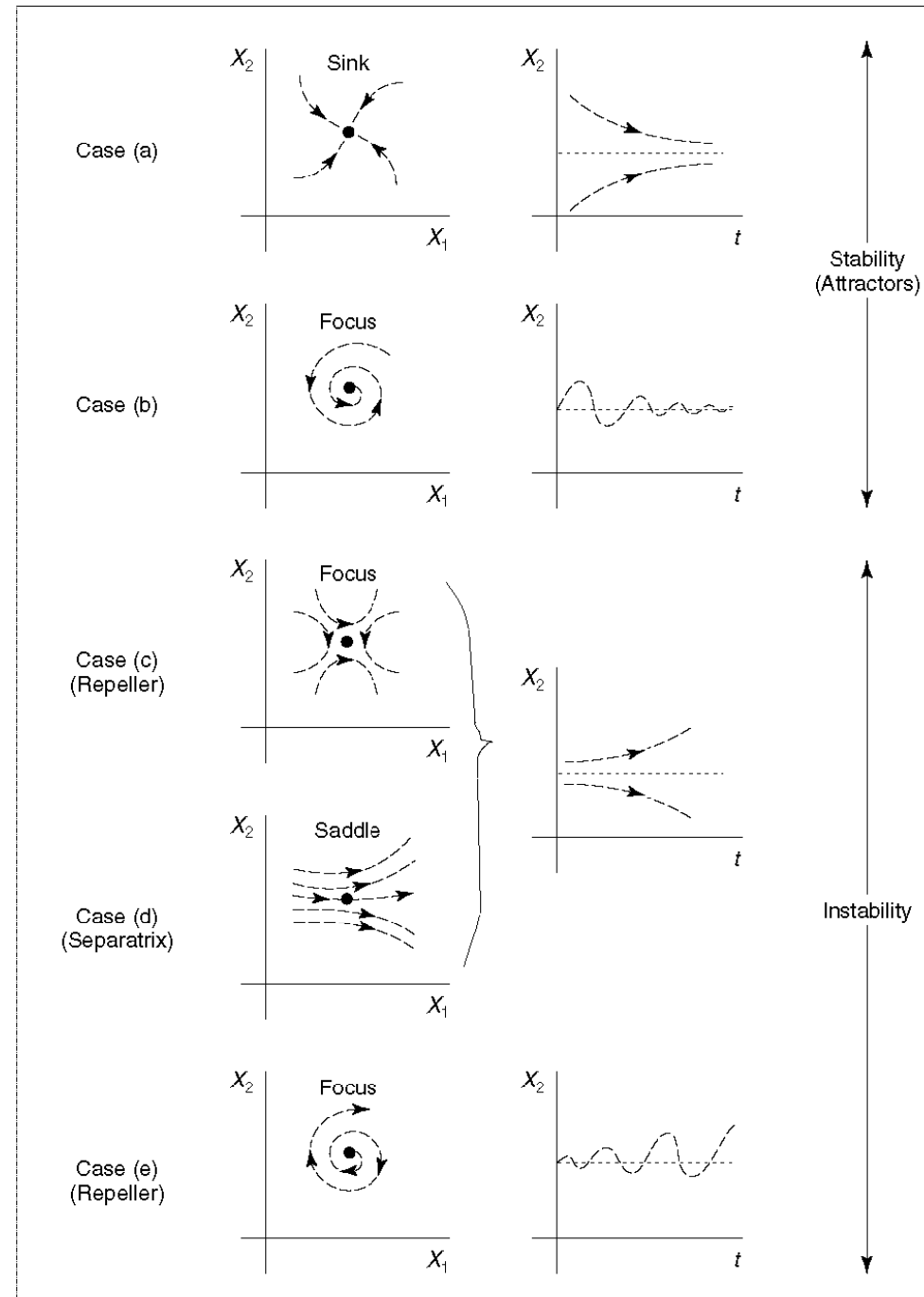
SOURCE: Seber and Wild (1989). Reprinted with permission.

**Figure A1.11** EXAMPLE OF A STOCHASTIC COMPARTMENTAL MODEL

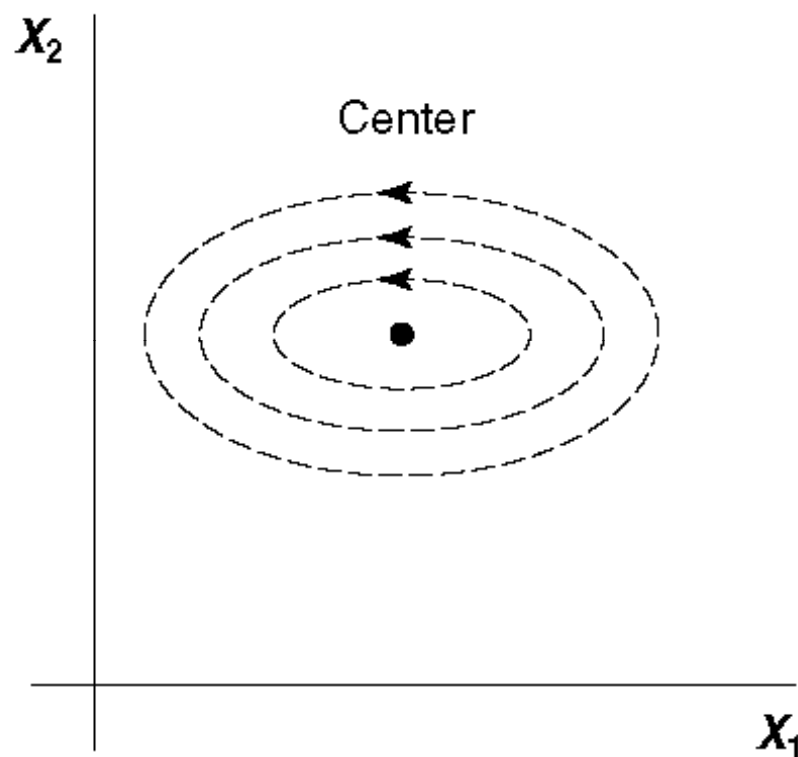


SOURCE: Søber and Wild (1989). Reprinted with permission.

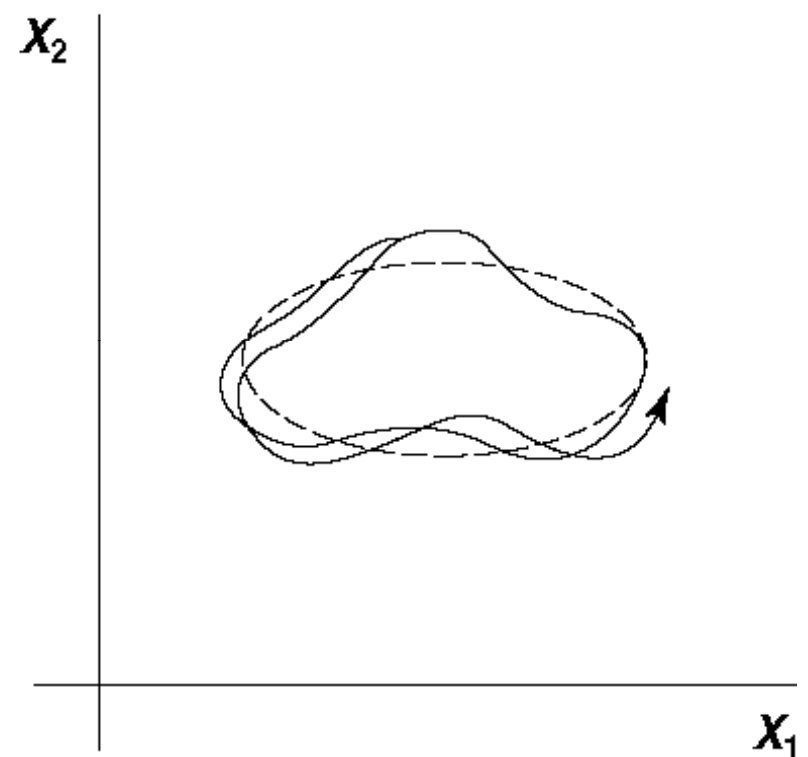
**Figure A1.12** STABLE AND UNSTABLE EQUILIBRIA



**Figure A1.13** PERIODIC TRAJECTORIES IN STATE SPACE



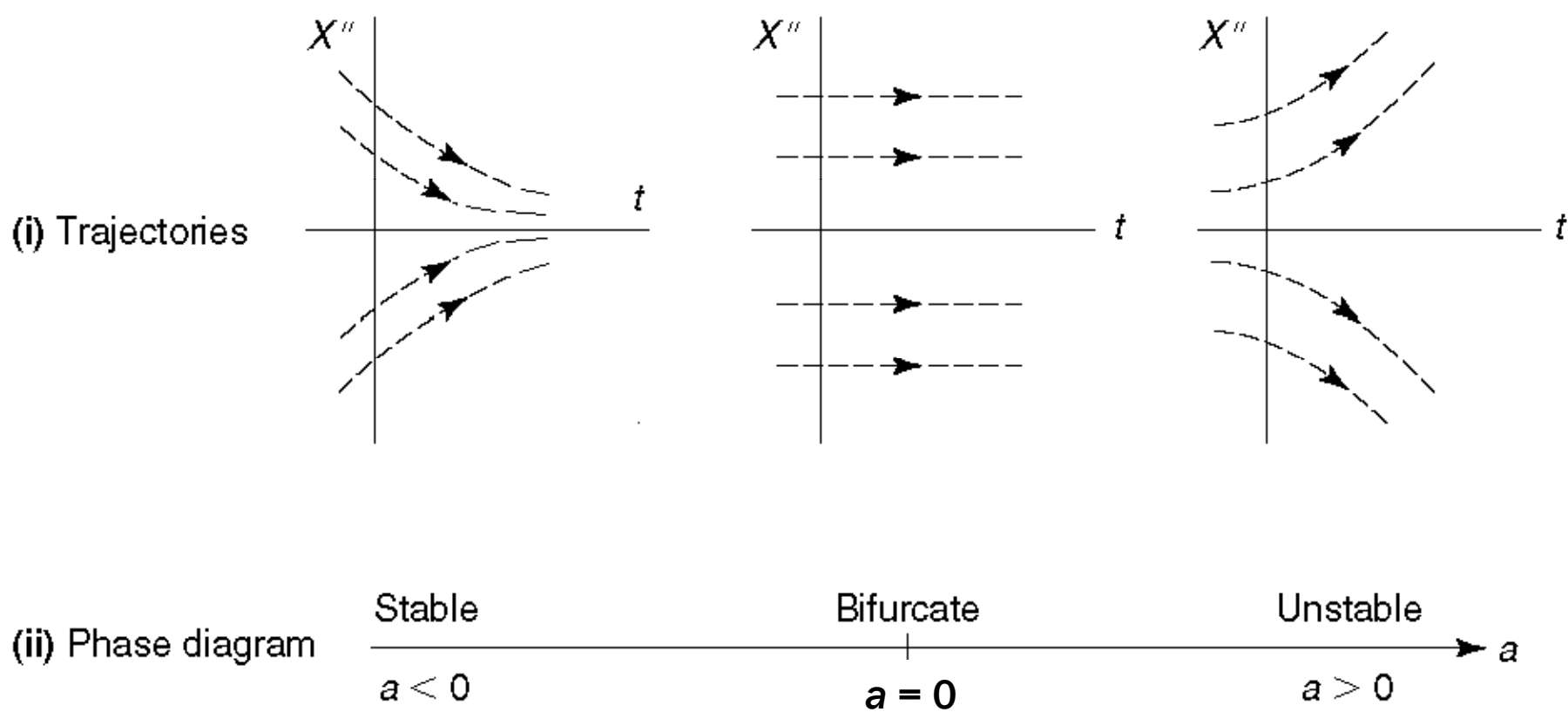
**(a)** Closed orbit (unstable)



**(b)** Limit cycle (stable)

SOURCE: Wilson (1981). Reprinted with permission.

**Figure A1.14** EXAMPLE OF A SIMPLE BIFURCATION



**Figure A1.15** GRAPHICAL SOLUTION OF A DIFFERENTIAL EQUATION

