When the area of the loop is perpendicular to the magnetic field lines, as shown in **Figure 8(a),** every segment of wire in the loop is moving parallel to the magnetic field lines. At this instant, the magnetic field does not exert force on the charges in any part of the wire, so the induced emf in each segment is therefore zero.

As the loop rotates away from this position, segments *a* and *c* cross magnetic field lines, so the magnetic force on the charges in these segments, and thus the induced emf, increases. The magnetic force on the charges in segments *b* and *d* cancel each other, so the motion of these segments does not contribute to the emf or the current. The greatest magnetic force on the charges and the greatest induced emf occur at the instant when segments *a* and *c* move perpendicularly to the magnetic field lines, as in **Figure 8(b).** This occurs when the plane of the loop is parallel to the field lines.

Because segment *a* moves downward through the field while segment *c* moves upward, their emfs are in opposite directions, but both produce a counterclockwise current. As the loop continues to rotate, segments *a* and *c* cross fewer lines, and the emf decreases. When the plane of the loop is perpendicular to the magnetic field, the motion of segments *a* and *c* is again parallel to the magnetic lines and the induced emf is again zero, as shown in **Figure 8(c).** Segments *a* and *c* now move in directions opposite those in which they moved from their positions in **(a)** to those in **(b).** As a result, the polarity of the induced emf and the direction of the current are reversed, as shown in **Figure 8(d).**

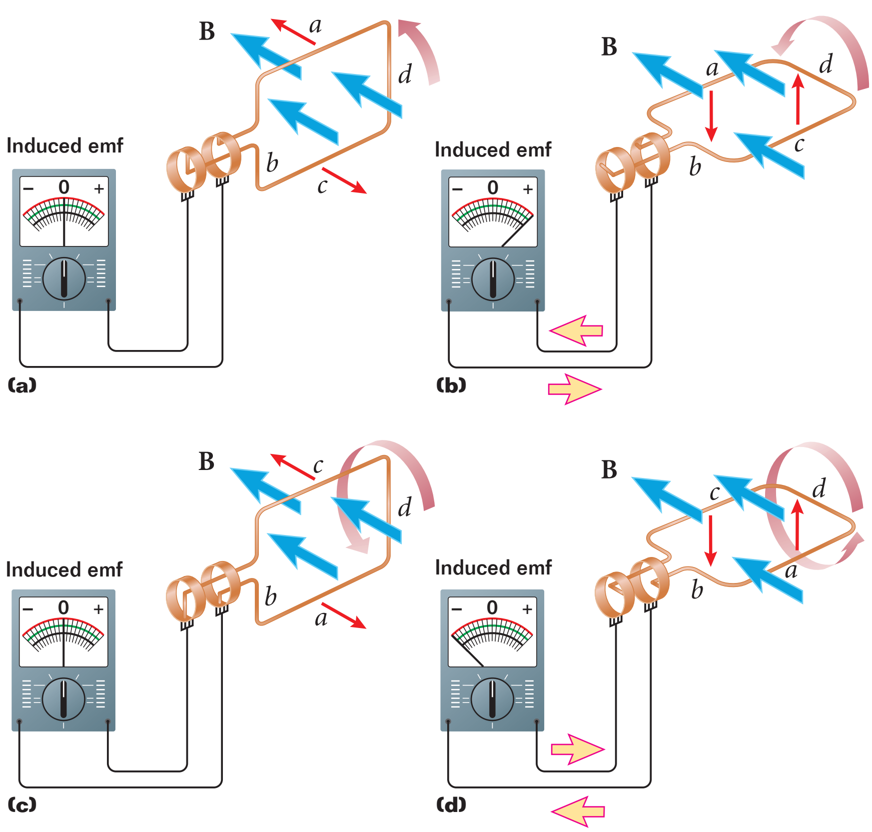

Figure 8
For a rotating loop in a magnetic field, the induced emf is zero when the loop is perpendicular to the magnetic field, as in **(a)** and **(c),** and is at a maximum when the loop is parallel to the field, as in **(b)** and **(d).**