**Appendix**

**Appendix A: Derivation of Eq. (13)**

For simplification, Eq. (13) is derived as follows:

If the flow-out velocity of the control volume is , which can be decomposed into a chordwise component and spanwise component, written as,  and , and the angels between the velocity and its components are  and , as shown in Figure 6a.

From the law of sines, the governing equation that describing the interactions between the velocities are given by:

 (A1)

The mass flow ratio, , may then be calculated by integrating Eq. (A1):

 (A2)

Where *A0*(*i,j*) and *A1*(*i,j*) are the cross section area of control volume along the chordwise and spanwise direction; *θ*0 and *θ*1 are the angles defined as shown in Figure 6a. In the current study, the two angels are very small (*θ*0 ≈ *θ*1 ≈ 0), also assuming that the height of control volume is equal for both cross section area, as illustrated in Figure 6b, thus Eq. (A2) can be further reduced to:

 (A3)