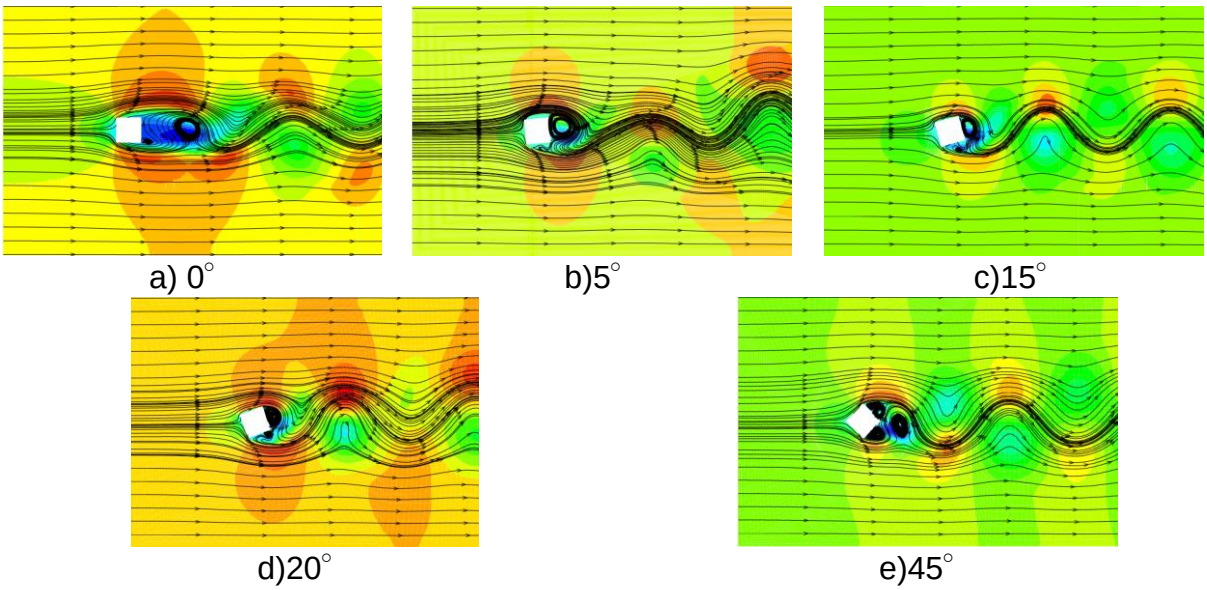
4. FLOW FIELD ANALYSIS

Based on the numerical simulation method, the flow field properties of the twisted rib can be modeled to analyze the oscillation mechanism. In this paper, the influence of the twist angle can be simulated by the two-dimension CFD.



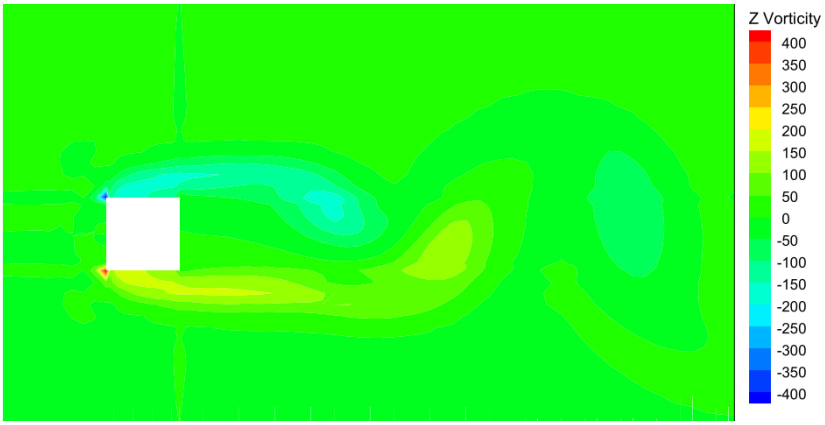
a) 0° b)5° c)15°

d)20° e)45°

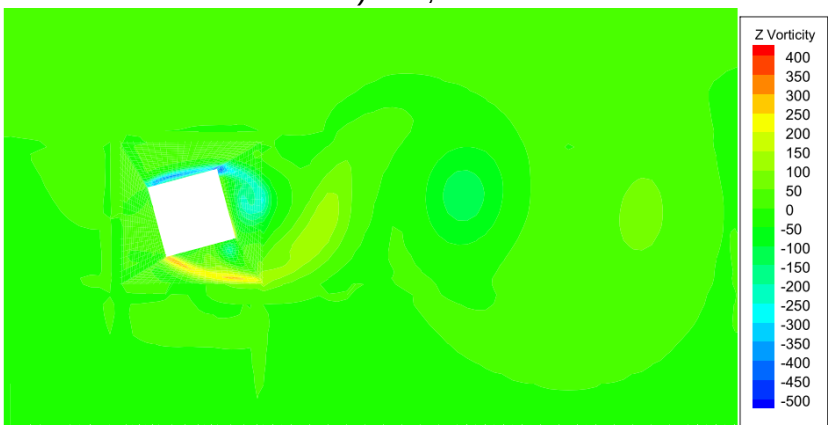
Fig.6 Streamline diagram for each twist angle

From the Fig.6, it can be indicated that, when the upper edge vortex is formed, a small vortex is formed on the lower edge simultaneously. And as the twist angle bigger, the size of the lower vortex become larger. So, it is can be explained from this perspective that, in the Fig.4 for the ORM, the maximum amplitude decreases with the increase of twist angle, because the lower vortex offsets part of the effects of the upper vortex, so the vibration is eliminated at the twist angle of 45.

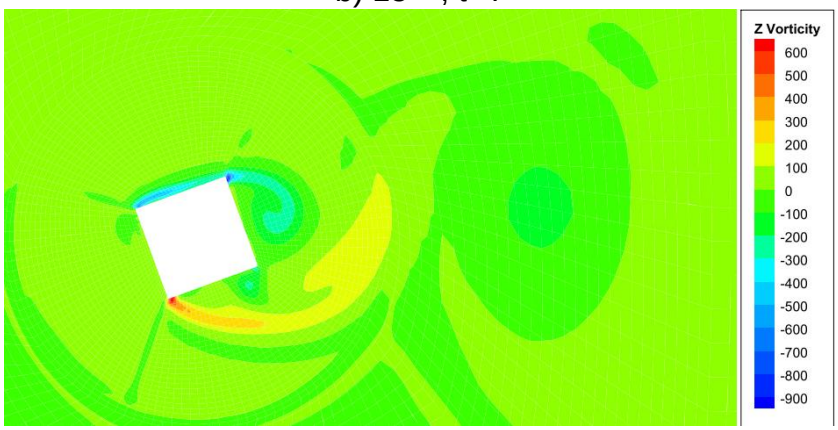
The vortex-induced vibration is significant induced by the vortex shedding, therefore, the vortex properties are also necessary to be simulated. Based on the Fig.6, streamline diagrams of 0°, 15°, 20° can clearly show the flow field changes, so vortex can be analyzed in the three conditions. Fig.7 shows that as the twist angle increases, the position of shedding vortex is closer to the downstream of the rectangle.From the view of vortex, the effect of the vortex on the structure is related to the vorticity and the position of the vortex. Combined with wind tunnel test results, it can be suggested the vorticity may be more important for the VIV.



a) 0° , t=T



b) 15° , t=T



c) 20° , t=T

Fig.7 Vortex diagram for each twist angle

5. CONCLUSION

For the atypical arch rib, the special aerodynamic shape can cause different structural responses, comparing with conventional rib. Experimental analysis indicates that the twisted configuration will decrease the VIV amplitude, improve the VIV performance of the rectangular rib. However, in some certain conditions, galloping

phenomenon appears at high wind velocity with atypical shapes. Numerical analysis can give the visual flow field that as the twist angle is bigger, the lower vortex offsets more part of the effects of the upper vortex and the vorticity may be more important factor than position of vortex in analyzing VIV.

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