

Chapter – 5

CONCLUSIONS

After making suitable modifications on a power loom, a stage of weaving a 3D shape was reached. Starting from weaving a hemisphere manually and then subsequent weaving on handloom, understanding geometry of 3D woven shape, evolving suitable technique of 3D shape weaving; designing, developing and fabricating suitable modifications on loom after experiencing several hurdles/ failures as well as successes, a set up for weaving 3D shape on power loom could be established. Conclusions of this entire work are as follows:

- i. A 3D woven shape can be viewed from two angles for developing a suitable method for weaving desired 3D shapes.
- ii. Viewing from one angle, it is a woven structure in which cross over points do not lie in same plane but lie in different planes. The extent of shifting of cross over points depend upon profile of 3D shape. Therefore, to develop a desired 3D woven shape, weaving process should incorporate suitable system of shifting planes of cross over points depending upon 3D profile of shape to be produced. On this principle, hemispherical and pyramidal shapes were woven using shaped slotted fins on hand loom. But this method is not adoptable on power loom.
- iii. Viewing from other angle, spacing of ends and picks in shaped regions vary. Extent of variation depends upon profile of 3D shape. Desired 3D shape can be produced on this principle by providing suitable modifications those will change spacing of ends and picks depending upon shape profile.

- iv. Spacing of ends is mainly influenced by spacing of dent wires as well as interlacement between ends and picks. On this principle reed with curved shaped wires is designed and fabricated. When this reed is displaced vertically, end spacing is changed. Through suitable arrangement of displacing reed vertically during weaving, desired change in spacing of ends can be obtained. Weave assist in changing spacing of ends if jacquard shedding is employed weaves are manipulated suitably.
- v. Spacing of picks is mainly influenced by rate of take up as well as interlacement between ends and picks. To change spacing of picks a take up motion that can take up individual ends at different rate from pick to pick, depending upon profile of shape is necessary. However, desired change in changing spacing of picks was attempted by weave manipulation. It was observed that pick spacing can be changed by weave.
- vi. When seamless 3D shapes are woven in folded form so that desired shape is produced on unfolding, control on fabric formation can be exercised comparatively with greater ease. As cloth fell lies in straight line, lesser problems arise in picking.
- vii. Method of weaving 3D shapes in folded form is suitable only for symmetrical shapes. It also puts greater restriction on upper limit of end density that can be taken.
- viii. Individual supply of warp threads from creel is necessary for weaving a 3D shape as contribution of ends in shaped region in fabric is different from one another. It is also necessary maintain uniform tension in all warp threads at all stages of weaving.

- ix. Actual dimensions of 3D shape woven out side loom are influenced by contraction. Therefore dimensions of 3D shape woven on loom should be taken larger in such a way that on contraction desired dimensions are obtained out side loom. Fabric contraction depends upon several factors like tension, fibre properties, yarn properties, weave, spacing of ends and picks etc. For a 3D woven shape, ends and picks per unit length keep on changing. Therefore amount of contraction would change from region to region. Hence, it becomes difficult to determine dimensions of 3D shape to be woven on loom that would on contraction produce 3D shape of required dimensions out side loom.
- x. Reed with shaped dent wires displaced vertically to shift line of beat up can change spacing of ends. Shapes of dent wires determine extent of change in end spacing. For geometrical shapes like a pyramid or a hemisphere shapes, shapes of dent wires can be determined with a suitable mathematical tool and computer.
- xi. The angle of shaped reed dent wire with vertical should be as less as possible. This can be minimized by increasing reed dimension height wise. The angle of shaped reed dent wire with vertical become very large for 3D Shapes having regions in which there is abrupt change in spacing of picks. Even with increased dimension of reed height wise, the angle of shaped reed dent wire with vertical does not reduce significantly and difficulties are experienced in changing spacing of ends as well as shedding.
- xii. While fabricating reed with shaped dents, each dent must be shaped precisely. All dents must be positioned accurately with

respect to one another. Shapes of dents must be retained against stresses of weaving. If these conditions are not fulfilled, difficulties arise in weaving in shedding and there by in picking, and exact shape is not produced. Precise fabrication of reed is a critical job.

- xiii. During weaving shaped regions width of warp in reed keep on changing. Suitable mechanism at cloth fell is necessary that will allow these changes in fabric at cloth fell and retain them. If this is not achieved, difficulties are experienced in weaving. The mechanisms developed for this purpose works well till cloth fell lies at front most position of reed. While weaving fabrics with higher weaving resistance, cloth fell shift backwards from front most position of reed and proper control is not exercised on fabric at cloth fell and hence weaving becomes difficult.
- xiv. Due to different conditions during weaving of 3D shapes, setting up jacquard shedding becomes difficult. How ever, jacquard shedding can be employed and shed is formed.
- xv. Programmable stepper motor drive with pulley and cord mechanism displaces reed satisfactorily to shift position of reed vertically.
- xvi. Final weaving set up consisted of major modifications of means for shuttle guidance and flight control, reed with shaped dents that is carried in a suitable bracket, jacquard shedding, weave that assists in shape generation, programmable stepper motor control for reed position control and mechanism to control fabric at cloth fell. Weaving takes place with this set up. However, mechanism that gives differential rate of take up across fabric width on successive picks which is necessary to

change spacing of picks as per 3D shape to be produced, could not be developed. Therefore shapes to exact dimensions could not be woven.