This thesis presents work in the direction of generating smooth surfaces from linear cross sections embedded in R2 and R3 using homotopy continuation. The methods developed in this research are generic and can be applied to higher dimensions as well. Two types of problems addressed in this research are reconstruction from an organised set of linear cross sections and reconstruction from an arbitrary set of linear cross sections. The first problem is looked upon in the context of acoustic signals wherein the cross sections show a definite geometric arrangement. A reconstruction in this case can take advantage of the inherent arrangement. The problem of reconstruction from arbitrary cross sections is a generic problem and is also shown to be solved here using the mathematical tool of continuous deformations. As part of a complete processing, segmentation using level set methods is explored for acoustic images and fast GPU (Graphics Processing Unit) based methods are suggested for a streaming computation on large volumes of data. Validation of results for acoustic images is not straightforward due to unavailability of ground truth. Accuracy figures for the suggested methods are provided using phantom object with known geometry. The results of the methods shown here can be used to gain objective knowledge about the reconstructed features. It is envisioned that due to the generic nature of the algorithms developed in this research, domains other than fisheries research can benefit from the reconstruction algorithms.