The first four actual frequencies are obtained from the Leissa's(Leissa, 1973) exact values. The convergence histories for the design variables are shown in Table 1.

Table 1

Identifying the boundary conditions of square plates.

Case 1 (S-C-S-C)				Case 2 (S-F-S-F)			
k	α_1	β_1	$f_{(z)}$	k	α_1	β_1	$f_{(z)}$
1	0.5000×10^{-1}	0.5000×10^{-1}	0.1293×10^{1}	1	0.5000×10^{-1}	0.5000×10^{-1}	0.3536
2	0.7253×10^{-2}	0.7136×10^{-2}	0.7447×10^{-1}	2	0.9756	0.1426×10^{1}	0.6108×10^{-1}
3	0.9443×10^{-3}	0.4855×10^{-2}	0.3609×10^{-1}	3	0.4517×10^{2}	0.4201×10^{1}	0.3693×10^{-1}
4	0.7251×10^{-4}	0.1843×10^{-3}	0.9623×10^{-2}	4	0.1650×10^{2}	0.6731×10^{1}	0.3382×10^{-2}
5	0.5790×10^{-4}	0.8938×10^{-4}	0.2543×10^{-2}	5	0.8405×10^{2}	0.6917×10^{2}	0.2088×10^{-2}
6	0.3254×10^{-4}	0.7051×10^{-4}	0.1721×10^{-3}	6	0.1373×10^{4}	0.2639×10^{3}	0.5219×10^{-3}
7	0.9827×10^{-5}	0.2677×10^{-4}	0.9354×10^{-4}	7	0.3428×10^{4}	0.8087×10^{4}	0.1078×10^{-3}
8	0.8618×10^{-5}	0.5109×10^{-5}	0.8407×10^{-4}	8	0.7807×10^{-4}	0.6878×10^{5}	0.9525×10^{-4}

5.2. Identifying the boundary conditions of the pavement-subgrade system

In the general the pavement-subgrade system can be modeled by a rectangular thin plate on elastic foundation. Most of the real pavements are constructed by many rectangular plates and these plates are joined together in various different ways. In reference(Zheng and Yao, 1994), it was shown that the various joint restraints for the pavement-subgrade system can be effectively simulated by the elastic restraint edges as equations (14). The actual boundary conditions are shown in Figure 3.

The following properties for an actual pavement-subgrade system are given:

length of the pavement $a = 5$ m

width of the pavement $b = 4$ m

pavement thickness $h = 0.24$ m

mass density $\rho = 552.03$ kg/ m^2

Young's modules of pavement material $E = 3.5\times10^3$ MPa

Poisson's ratio of pavement material $\mu = 0.167$

Winkler modules of the foundation $K = 6.35\times10^6$ kg/ m^2

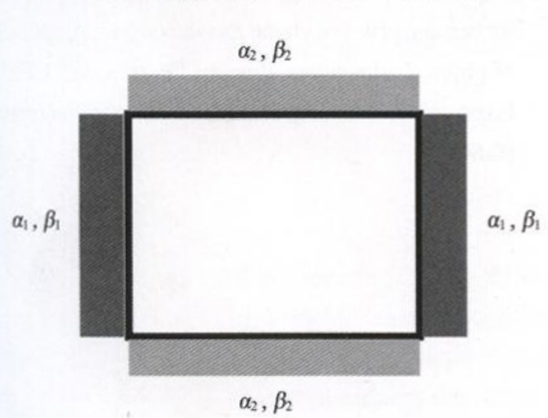

Fig.3. Actual boundary conditions for the pavement-subgrade system.

The first six frequencies are obtained by measuring an actual pavement-subgrade system. The convergence histories for the design variables are shown in Table 2. A comparison between the results in this paper and the results in reference(Zheng and Yao, 1994), is also listed in Table 2, which show good agreement.

6. Conclusions

In this paper, a numerical method is presented for identifying the boundary condition of the vibrating structures. The identification procedure is performed by combining the boundary element method with the optimization techniques. From this investigation we can see that boundary element methods seem to be superior to some domain methods in the boundary identification of