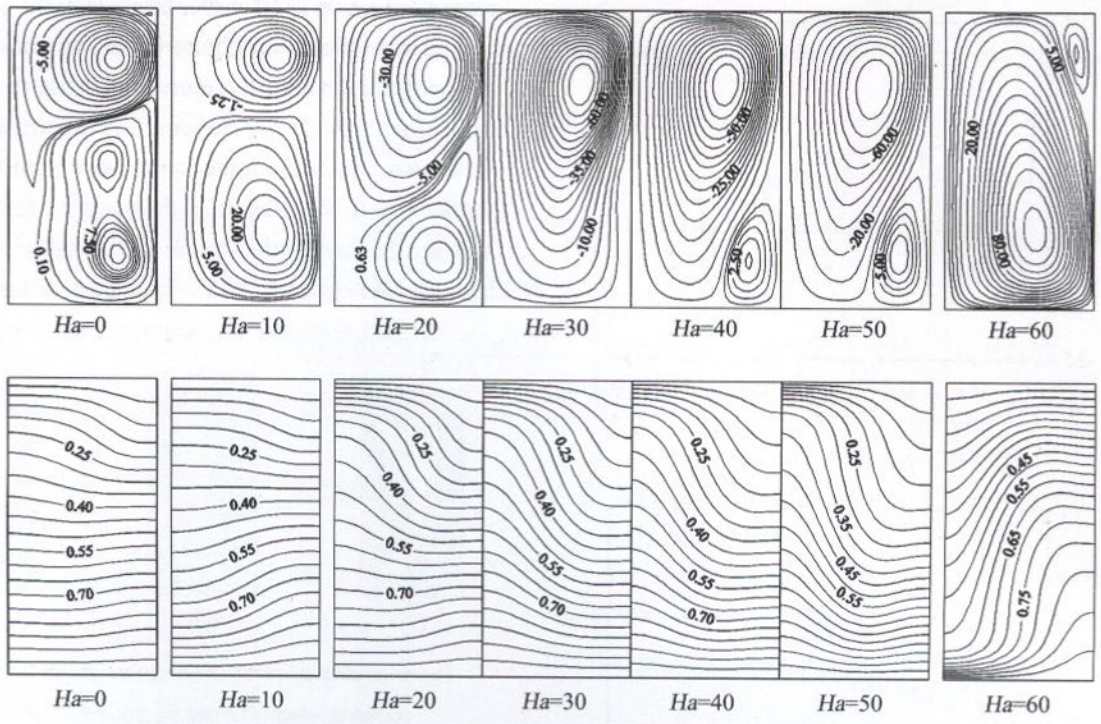

Fig. 5. Iso-contours of the dimensionless stream function and isotherms for different values of Ha,corresponding respectively to Gr_{Cr} =0.8×10^6; 1.1×10^6 ; 2×10^6 ; 1.8×10^6 ; 2.7×10^6 ; 4.1×10^6 and 6×10^6.

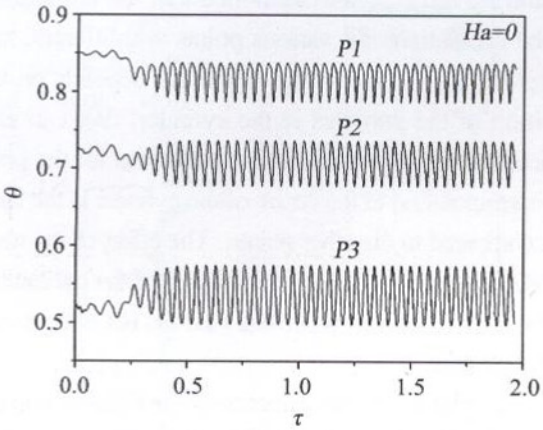

Fig. 6 . Time evolutions of the dimensionless temperature θ for Ha=0 and Gr_{Cr} =0.8×10^6 at three monitoring points P_1 (R=0.450, Z=0.288), P_2(R=0.450, Z=0.529) and P_3 (R=0.450,Z=0.923).

dimensionless radial velocity U at point P_3 (R=0.450, Z=0.923) during one period with the evolution of the flow structure at various dimensionless times (τ_a , τ_b , τ_c , τ_d) . Figures 7 and 8 indicate that the interval of instabilities is related to the dilation and contracting of the main and secondary cells.

The appearance of the unstable mode in the flow under the effect of the volume and buoyancy forces imposes a multicellular flow, the stability of this mode is done by the application of an external magnetic field. The idea to use this solution, that the electromagnetic force acted as opposition of the buoyancy force and causes a reduction of several fluid layers velocity. The increase of Gr_{Cr} with the Hartmann number Ha is clearly seen in the stability diagram (Gr_{Cr} – Ha). Figure 9 shows that this growth is monotonic with an exception for the value of Ha = 30, where a light reduction of Gr_{Cr} is obtained. This is probably connected to the mode dominating of the disturbance (the same result was obtained by Gelfgat *et al.* (2001), for A = 3). This is can be explained by the interaction of the vertical magnetic field on the convectif flow, this one is produced with the radial component of the velocity. Consequently, a stronger magnetic field is required to reach a stabilization for certain ascending values of the critical Grashof number, Gr_{Cr}

In order to obtain the energy spectrum of the oscillations, we use the Fourier transform inverse. On the Figure 10, we represent energy E , according to the dimensionless frequencies f of the oscillations. The analysis of the signal of the dimensionless radial velocity U for various values of Ha permits to show the periodic