$0^m.2 - 0^m.4$, in the brightness of the system which were inconsistent with the orbital period proposed by Abt et al. (1972). Photometric observations in the B and V-bandpass made by Halbedel (1985) revealed that HD 200776 is an eclipsing binary with both eclipses nearly identical, in contrast to the spectroscopic observations. He proposed a new orbital period of 3.0239 days, 3 percent longer than that given by Abt et al. (1972). Caton & Smith (2005, hereafter CS) published a new light curve and new times of mid-eclipses as well as a new orbital period of 1.5131273 days, nearly half that of given by Halbedel (1985). Later, Dallaporta & Munari (2006, hereafter DM) presented complete and accurate BV light curves of HD 200776 as well as three times for the mid-primary eclipse. Fortunately the same comparison star was used in the photometric observations of Halbedel (1985) and DM. No further spectroscopic observations were made for this eclipsing-spectroscopic binary after Abt et al. (1972).

The main aims of this study are: (1) to detect some lines of the secondary component; (2) to reveal radial velocities for both components; (3) to solve the radial velocity curves for the primary and secondary components on the basis of new observations in order to obtain accurate masses and radii; and (4) to determine the rotational velocities of the components and compare them with those expected for orbital synchronization.

2. SPECTROSCOPIC OBSERVATIONS

The spectra were obtained with several telescopes over the course of three years, beginning in 2007. Table 1 lists the full set of observations. The first set was observed with the Échelle spectrograph (FRESCO) at the 91 cm telescope of Catania Astrophysical Observatory. Spectroscopic observations were performed with the spectrograph fed by the telescope through an optical fibre (UV-NIR, 100 μm core diameter) and located, in a stable position, in the room below the dome level. Spectra were recorded on a CCD camera equipped with a thinned back-illuminated SITe CCD of 1k×1k pixels (size 24×24 μm). The cross-dispersed échelle configuration yields a resolution of about 22000, as deduced from the full width at half maximum of the lines of the Th-Ar calibration lamp. The spectra cover the wavelength range from 4300 to 6650 Å, split into 19 orders. In this spectral region, and in particular in the blue portion of the spectrum, there are several lines useful for measuring the radial velocity, as well as for spectral classification of the stars.

The system was also observed with the Turkish Faint Object Spectrograph Camera (TFOSC) attached to the 1.5 m RTT150 telescope on August 07–20, 2010 under good seeing conditions[4]. The wavelength coverage of each spectrum was 4100–9000 Å in 11 orders, with a resolving power of $\lambda/\delta\lambda$ 7000 at 6563 Å.

The electronic bias was removed from all spectra and we used the CRREJECT task of IRAF[5] for cosmic ray removal. The échelle spectra were extracted and wavelength calibrated by using a Fe-Ar and Th-Ar lamp source with help of the IRAF echelle package. The stability of the instruments was checked by cross-correlating the spectra of the standard star against each other using the FXCOR task in IRAF. The standard deviation of the differences between the velocities measured using FXCOR and the velocities in Nidever et al. (2002) was about 1.1 km s^{-1}.

Twenty-eight spectra of V1898 Cyg were collected during the two different seasons. Typical exposure times for the V1898 Cyg spectroscopic observations were between 2400 and 2600 s for the Catania telescope and 1200 s for the RTT150 telescope. The signal-to-noise ratio (S/N) achieved was between 70 and 115, and ∼150 depending on atmospheric condition. α Lyr (A0V), 59 Her (A3IV), ι Psc (F7V), HD 27962 (A2IV), and τ Her (B5IV) were observed during each run as radial velocity and/or rotational velocity templates. The average S/N at the continuum in the spectral region of interest was 150–200 for the standard stars.

3. SPECTROSCOPIC ANALYSIS

Double-lined spectroscopic binaries reveal two peaks in the cross-correlation function (CCF) between variable and the radial velocity template spectrum, which displace back and forth, as seen in Figure 1. The location of the peaks allows to measure the radial velocity of each component at the time of observation. The cross-correlation technique applied to digitized spectra is now one of the standard tools for the measurement of radial velocities in close binary systems.

The radial velocities of V1898 Cyg were obtained by cross-correlating échelle orders of the V1898 Cyg spectra with the spectra of the bright radial velocity standard stars α Lyr (A0V), 59 Her (A3IV) and ι Psc (F7V) (Nordström et al. 2004). For this purpose the IRAF task FXCOR was used.

[4]Further details on the telescope and the spectrograph can be found at `http://www.tug.tubitak.gov.tr`.

[5]IRAF is distributed by the National Optical Observatory, which is operated by the Association of the Universities for Research in Astronomy, inc. (AURA) under cooperative agreement with the National Science Foundation.